When installing rollers, place thrust washer between bearing and carriage frame. Replace roller expansion plug if it shows signs of leaking grease.

Place carriage in operating position in mast inner channel, using a chain hoist. Install top cross bar. Raise cylinder plunger until pull-down rod engages hole at center of cross bar and secure rod with nut. Raise plunger until block at base of inner channel can be removed. Raise carriage with chain hoist until chain can be connected with ease, and block in this position. Connect chain to carriage. Remove carriage block and check chain adjustment.

**CROSSHEAD REPLACEMENT**

Replace Crosshead. Raise carriage until mast inner slide is lifted about ten inches. Block carriage and inner slide in this position. Remove nut at top of pull-down rod. Operate lever to lower cylinder plunger. Disconnect lift chains. Remove screws fastening crosshead to plunger. Remove crosshead and lift rod assembly. Before installing crosshead, insert pull-down rod through hole at center of crosshead. Then place crosshead on plunger and secure with screws. Place chains on rollers and connect to outer channel cross bar. Operate control lever to lift cylinder plunger until pull-down rod engages hole in top cross bar and secure pull-down rod with nut. Raise inner channel and carriage and remove blocks.

Replace Crosshead Rollers. Raise carriage until mast inner slide is lifted about 10 inches. Block carriage in this position. Operate lever to lower cylinder plunger. Disconnect lift chains. Remove snap rings and rollers, then bearings can be replaced. When installing bearings and rollers, place a thrust washer at each side of roller.

With bearings and rollers secured with lock rings, engage chains with rollers and connect to outer channel cross bar. Remove carriage block.

**LIFT CHAINS REPLACEMENT**

Replace Lift Chains. Raise carriage approximately 1 foot. Block carriage in this position and lower cylinder plunger to release tension on chains. Disconnect chains at outer channel cross bar and remove nut from adjusting bolt.

To install chains, connect link to outer channel cross bar, engage chain with rollers, and connect adjusting bolt to carriage. Tighten lower nut on adjusting bolt about 1 inch, then check chain adjustment (see following paragraph).

**ADJUSTMENT**

Adjust Lift Chain Length. Lower carriage to its lowest point and lift mast to a vertical position. Turn chain adjusting bolt nuts to raise or lower carriage until bottom of forks just clear the floor with all slack removed from chain. Secure lock nut after adjusting chain.

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**TOWMOTOR SERVICE MANUAL**

**MODEL LT35**

The Service Manual is divided into major sections which are listed on the right side of this page. Quick reference to these sections can be made by placing the right thumb on the arrow of the desired section, bending the book back, and thumbing the pages to the corresponding tab.

**FOREWORD**

The service and repair information contained in this manual covers the lift trucks being currently produced and sold by the Towmotor Corporation. In many instances you will find recommendations for use of new improved parts when replacement is necessary. These are included so that you may derive all the benefits that are incorporated in the newer lift trucks.

Older models have not been completely illustrated or described in detail. However, the service instructions will apply in general to these units as they are basically the same in construction and operation.

In making parts replacements, be sure to use genuine Towmotor Repair Parts. Use of substitute parts results in lower operating efficiency of the lift truck.

**SERVICE DEPARTMENT**

**TOWMOTOR CORPORATION**
MODEL LT35
GENERAL INFORMATION

DESCRIPTION

Your Model LT35 lift truck is designed and engineered with the knowledge of 30 years experience, and if properly maintained, will give you years of satisfactory service.

The Towmotor is so designed that assemblies are accessible and can be repaired or replaced easily and quickly, thus keeping operating and maintenance costs at a minimum.

The driving controls and operation are of the conventional type with the exception of the steering axle which is located at the rear of the truck. The vehicle is equipped with a mechanical band-type brake mounted on the transmission.

The lifting and driving controls are located so that they are easily manipulated from the operator’s compartment.

A towing eye can be attached to the rear of the frame for towing purposes.

terial is removed from stuffing box, then install new packing.

When installing rings (one at a time in sequence listed in the following paragraphs), make certain that the ring lip is worked in smoothly and that ring is not twisted or distorted. Use a small screw driver to start rings into stuffing box. Then use a blunt-end tool to push the rings to the bottom of the stuffing box. A special packing tool can be made for this purpose (See Figure 78).

First, install the molded forming ring (flat side down). NOTE: This ring provides a seat for the succeeding rings. Then install 4 leather rings, one rubber ring, one leather ring, one rubber ring, in that sequence, and repack the remaining area in the stuffing box with leather rings until there is 0 to 1/16 compression after gland nut is tightened. Before installing gland nut, install new wiper ring at inside of nut. This ring may be of the felt type or may consist of a rubber ring with or without an expander ring mounted beneath it. Figure 78 illustrates the type with rubber wiper ring. When installing rubber ring type wiper, eliminate the expander ring as use of this ring has been discontinued.

After cylinder is repacked, connect piston rod eye to lift cylinder with pin. Secure pin with cotter pins and install plate on cotter pin.

Replace Tilt Cylinder Piston Cups or Packing. If mast lifts too slowly, check tilt cylinder operation as follows: Tilt mast forward to the extreme forward tilt position. Disconnect hose at the tilt cylinder front connection. While holding lever in the forward tilt position, check for oil flow through the disconnected opening. If oil flows out of opening, remove tilt cylinder and replace piston cups or packing as follows:

Loosen set screw or clamp screw in pivot eye and unscrew eye from piston rod. Loosen packing gland nut, then unscrew stuffing box, using a spanner wrench. Withdraw complete piston assembly from cylinder tube. Place piston rod in soft-jawed vise, unscrew nut, and remove piston and cups or packing from rod.

To reassemble old type cylinder: Place gasket, piston half, cup, spacer, cup, piston half on rod in that order, then secure with nut. NOTE: Make certain cup friction lip point in opposite directions. On new type cylinder, place seal ring in piston, packing in recess of piston, and piston on rod, then secure with nut and cotter pin. Install new seal ring on stuffing box and make certain lip is thoroughly cleaned before assembling cylinder. Carefully start piston rod in tube, taking care not to distort piston cups or packing. A special tool has been designed to eliminate any trouble encountered when replacing packing (See Figure 79). It can either be put in the cylinder tube before assembling the piston or slid over the packing before assembly. Push piston rod assembly all the way into cylinder. Install and tighten stuffing box. If gland nut leaks or if packing has been removed, repack cylinder as described in the preceding procedure. If repacking in not necessary, tighten gland nut securely.

MAST
REPLACEMENT

Replace Mast Assembly. Place receptacle under cylinder to catch oil that will drain from cylinder when oil line is disconnected. Disconnect oil line at lift cylinder. Remove pin to disconnect tilt cylinder. Remove lift forks. Remove mast support shaft pivot bolts. Remove mast assembly, using heavy lift equipment such as another Towmotor or chain hoist.

Before installing mast assembly, coat mast support shaft with chassis lubricant. Install mast assembly, using heavy lift equipment. Install pivot bolts. Connect tilt cylinder to lift cylinder and connect oil line. Fill and bleed hydraulic system.

CARRIAGE
REPLACEMENT

Replace Carriage and Rollers. Raise carriage until mast inner channel extends about 5 inches. Block carriage and inner channel in this position, placing block at the bottom of inner channel so that top cross bar can be removed. Lower cylinder plunger to release tension on chains. Disconnect chains at carriage. Disconnect pull-down rod from top cross bar. Remove top cross bar. Fasten chain hoist to carriage and lift carriage out of inner channel.

The rollers and bearings can be replaced by unscrewing lubricant fitting and roller pin lock nut.
**SERVICES TOWMOTOR MANUAL**

**REPLACEMENT**

Replace Tilting Cylinder. Remove left body side plate and plate at front of cowl panel so that tilting cylinder is more accessible. Disconnect oil lines and remove pins fastening tilting cylinder to lift cylinder and to frame bracket. Remove tilting cylinder assembly.

Before reinstalling tilting cylinder, connect pins with chain-link. Place tilting cylinder in mounting position and connect to frame bracket and lift cylinder with pins. Secure pins with cotter pins. Connect oil lines. Bleed hydraulic system and fill to correct level.

**TILT CYLINDER REPAIR**

Repair Tilting Cylinder Oil Leak. If there is only a slight seepage of oil past the cylinder packing gland nut, tighten nut. If leak does not stop or in excessive, inspect cylinder as follows:

1. Tilt mast and inspect cylinder piston rod for scratches or scored condition. Remove scratches or scores, using a fine emery paper, then polish with crocus cloth. If rod will not clean up to a smooth finish, it is recommended that the cylinder assembly be replaced. NOTE: If a cylinder with a scratched or scored rod is repacked, the new packing will soon be cut and will leak oil. If piston rod is O.K., remove plate at front of cowl panel and repack cylinder as follows:

   Tilt mast forward, disconnect tilting cylinder at lift cylinder and compress piston rod. Remove packing gland nut, using a spanner wrench to prevent damaging nut. Pull out old packing rings, using a sharp pointed tool. Make certain old packing material has been removed. Insert new packing rings, using a new packing gland nut. Tighten nut to specified torque. Reinstall tilting cylinder assembly.

**SERIAL NUMBER LOCATION**

Battery - Embossed in connecting strap between cells.
Carburetor - Stamped on metal disk riveted to top of throttle body.
Distributor - Stamped in plate on distributor body.
Engine - Stamped in plate on cylinder block at oil filler.
Generator - Stamped in plate on inspection band.
Starting Motor - Stamped in plate on inspection band.
Vehicles - Stamped in plate on top of cowl.

**CAPACITIES**

<table>
<thead>
<tr>
<th>System</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooling System</td>
<td>8 qts.</td>
</tr>
<tr>
<td>Crankcase</td>
<td>3 qts.</td>
</tr>
<tr>
<td>Fuel Tank</td>
<td>3 gal.</td>
</tr>
<tr>
<td>Hydraulic System</td>
<td>3 gal.</td>
</tr>
<tr>
<td>Steering Gear</td>
<td>1 gal.</td>
</tr>
<tr>
<td>Transmission - Differential</td>
<td>3 pts.</td>
</tr>
</tbody>
</table>

**OPERATION**

PLACING NEW TOWMOTOR INTO SERVICE

The TOWMOTOR is shipped with gasoline drained. Cooling system is filled with water in summer and anti-freeze in winter. Crankcase is filled with oil to correct level. One battery terminal is disconnected.

Because the above conditions may vary in some instances, it is imperative that the following items be checked before starting engine.

1. Check fuel in tank and fill if necessary.
2. Check water level in radiator (or anti-freeze in winter).
3. Check crankcase oil level. (It is recommended that oil be changed after the first few days of operation).

**CONTROLS and INSTRUMENTS**

Location and identity of the driving and lifting controls are illustrated in Figure 1.

The switches, instruments and carburetor choke control are mounted on the instrument panel as shown in Figure 2.
To drive vehicle forward, pull long lever to the rear and push the short lever forward, accelerate engine and release clutch pedal slowly. When sufficient speed has been reached in the low (starting) speed range, remove foot from accelerator pedal and depress clutch pedal. Then push long shift (black knob) lever forward, accelerate engine and release clutch pedal.

To operate vehicle in reverse, pull short lever (red knob) to the rear and follow same directions as outlined above. CAUTION: Always stop vehicle completely when shifting short shift lever (red knob) to change direction of travel.

Stopping. Release accelerator pedal and depress brake pedal gradually. Before truck comes to a complete stop, depress clutch pedal to release clutch and prevent engine from stalling.

Parking Brake. When the brake pedal is depressed, a ratchet engages a dog attached to the floor plate and holds the pedal in the applied position to provide a parking brake (Figure 1). To release pedal, pull rear of pedal pad.

OPERATING LIFT EQUIPMENT

The levers that control lifting and tilting of the hoist mechanism are located in front of the operator within easy reach.

Lifting. Lifting and lowering action is controlled by the left-hand lever (black knob). Pull the lever back to lift or push lever forward to lower. When the lever is released, it will automatically return to the intermediate position, which is neutral.

The speed of lifting is controlled by the speed of the engine and position of the lever. Slight acceleration of the engine and gradual movement of the control lever from neutral to lifting position will produce a slow lifting action. Increase speed of engine and pull lever back as far as possible to increase speed of lifting.

Fig. 3. Transmission Shift Lever Positions

Fig. 4. Lift Equipment Operating Positions

Fig. 5A. Special Tool for Reaching Tilt and Lift Cylinders

Fig. 5B. Tilt Cylinder and Mounting (Old Type)

Fig. 5C. Tilt Cylinder and Mounting (New Type)
The lowering speed is controlled by the weight of the load and the position of the control lever. Push the lever forward gradually and slowly to obtain smooth action. To increase speed of lowering, push the lever forward as far as possible. CAUTION: Do not jerk the load, always move the tilt control lever gradually and slowly.

**Tilting**
- Tilting of the mast is controlled by the right-hand lever (red knob). Push lever forward for forward tilt or pull lever back for backward tilt.
- Speed of the engine controls the speed of tilting action. CAUTION: Never tilt an elevated load unless the load is deposited on a stock pile.

**Pickup of Load**
- (Figure 4). Aline truck with load and adjust fork position to balance the load to be picked up. With mast vertical or tilted backward slightly, lower forks and load.
- **NOTE**: If picking up a drum or cylindrical object flush with ground, tilt forks until tips touch the ground. Operate vehicle slowly forward until load touches carriage. Tilt mast backward, then raise carriage to load line above 10 inches.

**Transporting Load**
- (Figure 4). With lift and control levers in neutral position, drive vehicle to desired location. CAUTION: Watch for overhead obstruction that mast cannot clear.

**Depositing Load**
- (Figure 4). When the desired location has been reached and the load is raised or lowered to the desired height, tilt mast slightly forward. Drive vehicle forward, placing load in final position, then lower forks until they are free and back vehicle away.

**Operating Suggestions and Cautions**

For aid in handling your TOWMOTOR in a safe and efficient manner, remember the following:

- **Load Capacity**. Do not lift or carry loads beyond the rated capacity of the vehicle.
- **Mast Position**: Always lift loads with the mast vertical or in a slightly backward tilt.
- **Load Position**: Never transport loads in a high raised position.
- **Lift Operation**: Do not raise or lower load while traveling. Wait until unloading location has been reached.
- **Ramp Operation**: Always use low gear on down ramps with heavy loads. Always go down a ramp backward when carrying a load.
- **Stopping and Starting**: Avoid sudden stops and starts.
- **Bulky Loads**: Drive backwards when transporting bulky loads. This provides better driving vision.
- **Bumping**: Do not bump loads into position. Fork Position. Spread forks according to load width. Do not lift with one fork.

**General Operation**
- Do not run over sharp objects, bumps, or curbs.
- To Prevent Overturning. Never tilt heavy elevated loads forward except when directly over the unloading place with the load as low as possible.

**Preventive Maintenance**

Some Minutes Are Worth Hours and Dollars

Repairs cost time and money. So does sluggish performance. Avoid them by giving your TOWMOTOR a few minutes regular check-up and care every day. Don't neglect it just because it is built to stand hard service. Your TOWMOTOR can "take it"... will stand up, and give good service even under abuse. But it deserves care. Make it a regular habit right from the start to give your TOWMOTOR the care it deserves. You'll find it pays dividends over and over in many extra hours of dependable performance, twenty-four hours a day. It is very important that any new engine be operated with moderation until it has limbered up. Operate a cold engine under a light load until normal running temperature is reached.

Refer to Preventive Maintenance Chart for points requiring periodic attention.

**Other Important Points Are Listed Below**:

- **Keep Gasoline Filter Clean**
  Use Clean Gasoline From Clean Containers

- **Keep Carburetor Air Cleaner Clean**
  Check Once or Twice Daily if Air Is Full of Dust

- **Keep Radiator Clean**
  Outside As Well As Inside

- **Change Engine Oil Regularly**
  Use A Good Grade

- **Lubricate All Moving Parts Regularly**

- **Keep Clutch Properly Adjusted**

- **Keep Engine Clean**

- **Check Water Level In Battery At Regular Intervals**

In general, if careful care and maintenance do not keep your TOWMOTOR in satisfactory condition, consult the factory at 520 East 16th Street, Cleveland, Ohio. We will gladly make suggestions based on our experience.

In connection with the Hydraulic System, a periodic check should be maintained to see that no dirt clogs the Oil Tank Filler Cap. A plugged Filler cap, will cause the tank to collapse, due to the vacuum created when the oil flows into the cylinders.
RELIEF VALVE REPAIR

A relief valve "blows off" or unloads pressure when operating cylinders have reached their maximum extent of operation. On old type control valve, the relief valve is of a fixed type and requires no adjustment. The new type is adjustable through a set screw; however, the adjustment is correctly set at the factory and should not be changed unless the valve trips before the load is lifted, or if pressure is not unloaded when operating cylinders have reached their maximum extent of operation.

When adjustment is necessary, remove the acorn nut, loosen lock nut, and turn set screw clockwise to increase or counterclockwise to decrease spring tension. If valve "blows off" before load is lifted, using capacity load on lift forks, increase spring tension. If valve does not "blow off" when maximum lift or tilt has been reached, decrease spring tension. If all adjustment is taken up and the load still cannot be lifted, the relief valve should be taken apart and checked for worn or damaged parts.

NOTE: The relief valve should always be set to pick up capacity load, plus one additional turn for safety.

Disassemble Control Valve. To disassemble valve for cleaning purposes, remove hexagon cap at bottom of plunger and withdraw plunger assembly from housing. Remove both plungers in this manner. Each should be marked and pull-down rod assembly returned to its original position.

To remove check valves on old type control valve, unscrew hexagon caps at lower ends of plungers and eyes at upper ends of plungers. To remove relief valve, unscrew the two hexagon caps located between the eye ends of the plungers.

On new-type control valve, unscrew hexagon caps at lower ends of plungers and eye at upper end of the plunger which is located next to the relief valve. To remove relief valve, unscrew hexagon cap located to the right of the eye ends of the plungers.

Clean and Inspect Valve. Wash all parts in a clean solvent. Blow all passages in control valve housing with compressed air. Inspect valve balls for grooves or other defects that may indicate poor seating. Inspect for broken or distorted springs. Replace faulty parts. Inspect plungers for grooves or wear. See that plungers fit in housing with a slight hand pressure. There should not be any perceptible side clearance. If plunger is loose or faulty in other respects, replace valve assembly. When reassembling valve, use all new seals.

Assembly Valve. To install relief valve on old type control valve, place ball and spring in seat channel and secure with cap and seal ring. The assembly is secured in control valve with large cap and gasket.

On new-type control valve, place plunger in seat, followed by spring and gasket. Secure with seal ring and adjusting cap. Readjust relief valve after control valve is assembled.

To install check valve in eye end of plunger, drop ball and spring into inner channel and secure with seal ring and seal.

To install check valve in lower end of plunger, drop ball and spring into plunger channel, then place flat washer, plug, or clip faulty part, and then flat washer on lower end of plunger and secure with hexagon cap and seal ring. Install plunger assembly from lower end of valve housing and secure in place with hexagon cap and gasket. Install plunger oil seal in housing.

LIFT CYLINDER

REPLACEMENT

Replace Lift Cylinder. Raise carriage and inspect counter-plunger for scratches or scored condition. Remove scratches or scores, using a fine emery paper, then polish with a smooth cloth. If plunger will not clean up to a smooth finish, it is recommended that the cylinder be replaced. NOTE: If a cylinder with a scratched or scored plunger is repacked, the new packing will soon be cut and will leak oil. If plunger is O.K., repack cylinder as follows:

LIFT CYLINDER REPAIR

Repair Lift Cylinder Oil Leak. If oil is seeping past gland nut, tighten nut. If leak does not stop or is excessive, inspect cylinder as follows:

Raise carriage and inspect counter-plunger for scratches or scored condition. Remove scratches or scores, using a fine emery paper, then polish with a smooth cloth. If plunger will not clean up to a smooth finish, it is recommended that the cylinder be replaced. NOTE: If a cylinder with a scratched or scored plunger is repacked, the new packing will soon be cut and will leak oil. If plunger is O.K., repack cylinder as follows:
oil under pressure to the operating cylinder. For a detailed description of operation, refer to the beginning of this section.

**CONTROL VALVE REPLACEMENT**

Disconnect hydraulic hoses at valve. Remove clevis pins fastening control levers to valve plungers. Remove screws fastening valve to tank. Remove valve assembly.

When installing control valve, use new seal rings between valve and tank. (Old type uses 2 and new type uses 1.) Fasten valve assembly securely to tank, using either copper or lock washers on attaching screws, depending on which type washers were originally used. If replacing control valve on Serial No. 354694 or below, substitute four lock washers for copper washers. Connect control levers and hydraulic lines.

**CONTROL VALVE REPAIR**

If the control valve assembly is faulty, it is recommended that you contact your Towmotor Factory Representative. The control valve requires no service other than cleaning if the valve should become inoperative due to dirt or foreign material in the oil system. To prevent this situation from occurring, the oil in the system must be kept free of all dirt or sediment.

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CONTROL VALVE BODY</td>
</tr>
<tr>
<td></td>
<td>and OPERATING PLUNGERS</td>
</tr>
<tr>
<td>2</td>
<td>BALL, check valve</td>
</tr>
<tr>
<td>3</td>
<td>CAP, check valve</td>
</tr>
<tr>
<td>4</td>
<td>CAP, operating plunger</td>
</tr>
<tr>
<td>5</td>
<td>CAP, relief valve adjusting</td>
</tr>
<tr>
<td>6</td>
<td>EYE, operating plunger</td>
</tr>
<tr>
<td>7</td>
<td>Gasket, operating plunger cap</td>
</tr>
<tr>
<td>8</td>
<td>GASKET, relief valve screw</td>
</tr>
<tr>
<td>9</td>
<td>GUIDE, relief valve spring</td>
</tr>
<tr>
<td>10</td>
<td>NUT, arm, relief valve adjusting screw</td>
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<tr>
<td>11</td>
<td>NUT, hex., relief valve adjusting screw</td>
</tr>
<tr>
<td>12</td>
<td>PLUG, pipe</td>
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<td>PLUG, pipe</td>
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<td>SEAL, relief valve</td>
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<td>SPRING, check valve</td>
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<td>25</td>
<td>SPRING, plunger return</td>
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<tr>
<td>26</td>
<td>SPRING, relief valve</td>
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<tr>
<td>27</td>
<td>WASHER, plunger return spring</td>
</tr>
<tr>
<td>28</td>
<td>RING, seal, control valve to tank</td>
</tr>
<tr>
<td>29</td>
<td>SCREW, cap, control valve to tank</td>
</tr>
<tr>
<td>30</td>
<td>WASHER, lock, control valve to tank screw</td>
</tr>
</tbody>
</table>

Fig. 72. Control Valve - Exploded View

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**LUBRICATION CHART**
LUBRICATION DATA

For Correct Lubrication, use the following or equivalent:

1. LIFT CHAIN PIN AND ROLLERS
   - Clean and oil
   - Engine oil SAE 30

2. PINCHROLL ROLLERS
   - Pressure gun
   - Chassis lubricant

3. CRANKSHAFT ROLLERS
   - 4 points
   - Pressure gun
   - Chassis lubricant

4. MAST HINGE SHAFT
   - Pressure gun
   - Chassis lubricant

Frequency Key
- Lubricate every 50 hrs.
- Lubricate every 6 mos.

Items 23, 25, 26, 27 - Special Attention - See Lubrication Data.

LUBRICATION

The chart below presents a ready reference to items that require lubrication and the frequency of lubrication. The items are arranged clockwise in numerical sequence, starting from the front center of the TOWMOTOR. Items that have two or more points of lubrication on opposite sides of the component are indicated by broken lines. For more detailed lubrication information, refer to the same item number under heading Lubrication Data.

PUMP REPAIR

If tools and testing equipment are not available, it is recommended that an exchange pump be procured from your Towmotor Factory Representative. The following procedures have been developed to aid in the disassembly and inspection of the pump if there is indication that the pump may be faulty.

Disassemble Pump. Remove keyed coupling from pump shaft, using a puller. Remove key from shaft slot. Remove screws securing pump body to flanged cover. Tap body loose from cover and remove cover, gasket, and pressure-loading spring. Remove relief valve spring and ball from hole in cover. To remove seal in cover, use an arbor press. Remove the cover bearings, gear and shaft assemblies, and bearing from body.

Inspect Pump. Wash all parts in clean unleaded gasoline. Inspect gears for chipped, cracked, or worn teeth. Inspect bearing surfaces for grooves or wear. If faces of bearings adjacent to gears are scored slightly, they can be resurfaced using crocus cloth placed on a flat surface plate. If the bearing face is to be resurfaced, care must be taken to keep the bearing flanges of equal thickness, so that they will be flat and parallel when installed in the body and cover.

If gears, bearings, and body appear to be visually satisfactory, inspect pump for correct clearances as follows:

Inspection gear tooth to body wall clearance by measuring inside diameter of body wall and outside diameter of the gear teeth. If this clearance exceeds .005 inch, replace worn parts or pump assembly.

Inspect bearing to gear journal clearance by measuring the outer diameter of the gear journal and the inside diameter of the bearings. If this clearance exceeds .005 inch, replace worn parts or pump assembly.

Assemble Pump. Install body bearings and inspect clearance between the flat sides of the bearings. If the clearance exceeds .005 inch, both bearings should be replaced.

NOTE: When new bearings are installed, it may be necessary to dress the bearing flats so that the bearings can be installed in body without binding. Dressing can be accomplished by using crocus cloth placed on a flat surface plate. CAUTION: Remove only enough material to produce a sliding fit with clearance not exceeding .005 inch after bearings are installed. Install gears in body bearings.

Install cover bearings on gear journals and check flint clearance. If the clearance exceeds .005 inch, both bearings or pump assembly should be replaced.

NOTE: If new cover bearings are to be installed, it will be necessary to drill a hole (3/16 inch diameter) to a depth of 1/2 inch from the gasket surface of the body in the intake side of the bearing flanges to accommodate the rubber pin. The bearing should be in mounting position and a guide template and flat bottom drill should be used when drilling this hole.

After drilling operation, remove the cover bearings, gears, and body bearings, and to clean out the drill chips, then remove the burrs formed on the cover bearing flanges during drilling operation. Recheck the flat clearance to make sure that the cover bearings are flat to move on the gear journals.

With body bearings, gears, and cover bearings installed, install a new rubber pin in hole at the corner of the flat sides of the bearings. Coat seal rings with oil and install them in the recessed bore of the cover. Place the pressure-loaded spring in the recessed bore of the cover. Drop ball into the threaded cover hole, then tap ball lightly with a brass rod to assure correct seating. Spring pressure on the ball will hold the ball in place in the cover. Secure cover to body with screws and flat washers.

The adapter cover is equipped with two seal rings. If pump is disassembled, it is recommended that this adapter cover be removed and new seal rings installed.

CONTROL VALVE

DESCRIPTION

Two types of control valves were used on Model LT35. The old type (fixed-pressure type valve) can be identified by the relief valve, which is located below and between the operating plungers. The relief valve on the new type is to the right and parallel with the operating plungers.

The control valve is mounted on the bottom side of the oil supply tank. Its function is to distribute...
sively in this type pump. The oil pressure developed by this pump is used to maintain the correct clearance between the gears and bearings. This is accomplished by diverting oil, under pressure from the discharge port, to the under side of the bearings thus forcing the bearings against the faces of the gears. Rubber seal rings mounted on the cover bearings retain the oil pressure between body and bearings.

The small holes drilled in the cover connect the gear shaft ends with the drive seal chamber. A channel leading from this channel to the intake port is equipped with a relief valve which opens under a predetermined pressure and bypasses the oil to the intake port.

PUMP REPLACEMENT

The hydraulic pump is mounted on the engine mounting floating plate directly beneath the radiator. The pump is connected to the crankshaft pulley by a coupling (Figure 11).

Replace Pump and Coupling, Remove radiator and muffler. Disconnect hose at pump. Remove bracket

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1. **MAST SLIDERS**
   - Apply with brush
   - Lead soap (Lead-rich) Extreme Pressure Grease having No. 6 consistency. (Approximate lead soap from 74%)

2. **DRIVE GEARS**
   - Clean & repack every 6 mo. or when replacing bearings.
   - Sodium lead soap base grease. Dropping Point - 250°F.
   - ASTM worked penetration at 77°F - 228-246. Viscosity of oil used in compounding - 190 S.S.U. at 210°F.

3. **WHEEL BEARINGS**
   - Clean and repack each 6 months operation.
   - Sodium base non-fibrous grease. Dropping Point - 430°F.
   - ASTM worked penetration at 77°F - 299-323. Viscosity of oil used in compounding - 790 S.S.U. at 210°F.

4. **FACERASHEFT BEARINGS**
   - Pressure gun
   - Chassis lubricant

5. **SHAFT PEDAL SHAFT**
   - Pressure gun
   - Chassis lubricant

6. **STEERING GEAR**
   - Drain and refill SAE 140 Gear or Transmission oil (Winter and Summer)
   - Capacity - 1 qt.

7. **DING LINK**
   - Pressure gun
   - Chassis lubricant

8. **CLUTCH PEDAL SHAFT**
   - Pressure gun
   - Chassis lubricant

9. **SPRING SLIDERS**
   - Pressure gun
   - Chassis lubricant

10. **SPRING LEAVES**
    - Spring Base Oil

11. **WHEEL BEARINGS**
    - Clean and repack each 6 months operation.
    - Sodium base non-fibrous grease. Dropping Point - 430°F.
    - ASTM worked penetration at 77°F - 240-246. Viscosity of oil used in compounding - 190 S.S.U. at 210°F.

12. **BRAKE PEDAL SHAFT**
    - Pressure gun
    - Chassis lubricant

13. **CLUTCH PEDAL SHAFT**
    - Pressure gun
    - Chassis lubricant

14. **SPRING SLIDERS**
    - Pressure gun
    - Chassis lubricant

15. **SPRING LEAF**
    - Spring Base Oil

16. **WHEEL BEARINGS**
    - Clean and repack each 6 months operation.
    - Sodium base non-fibrous grease. Dropping Point - 430°F.
    - ASTM worked penetration at 77°F - 299-323. Viscosity of oil used in compounding - 190 S.S.U. at 210°F.

17. **KING PIN**
    - Pressure gun
    - Chassis lubricant

18. **TIFF DOOR PINS**
    - Pressure gun
    - Chassis lubricant

19. **GENERATOR**
    - 6 drops engine oil SAE 10

20. **SPRING SLACKER BOLT**
    - Pressure gun
    - Chassis lubricant

21. **FAN PULLEY**
    - Remove plug and fill hub half-full engine oil SAE 10

22. **DRAG LINK**
    - Pressure gun
    - Chassis lubricant

23. **DISTRIBUTOR**
    - 6 drops engine oil SAE 10

24. **CRAKCASE**
    - Check level each day, drain and refill each 50 hours operation:
    - Summer: SAE 30 engine oil
    - Winter: SAE 20 engine oil
    - Refill with 3-1/2 qts.

25. **CLUTCH RELEASE SHAFT**
    - 10 drops engine oil in each of the two oil holes SAE 10

26. **CLUTCH RELEASE BEARING**
    - 10 drops engine oil SAE 10 (every 50 hrs.)

27. **UNIVERSAL JOINT**
    - Repack only when joint has been disassembled for repair or other purposes.
    - Long Fibre Sodium Base Grease conforming approximately to the following specifications:
      - S.A.T.M. Worked Penetration at 77°F, 270 Viscosity of oil used in compounding, 192 SUS @ 210°F

28. **AIR CLEANER**
    - Clean and refill to indicated level.
    - NOTE: Under extremely dusty operating conditions, clean and refill once or twice daily.
    - SAE 30 engine oil - Summer SAE 20 engine oil - Winter

29. **TRANSMISSION**
    - Check level each 50 hours operation
    - Drain and refill each 6 months.
    - Summer: SAE 50 engine oil
    - Winter: SAE 20 engine oil
    - Capacity: 3 pts.

POINTS NOT INDICATED ON CHART

CONTROL BOX PIVOT POINTS
- Lubricate pivot points such as accelerator linkage, lift cylinder pivot pin, clutch linkage, and brake linkage with oil as used in engine oil. Each 50 hours operation.

HYDRAULIC SYSTEM
- Drain and refill each 6 months operation.
- Use a premium grade SAE 10 conforming to the following specifications:
  - Gravity: 21
  - Pour Point: -50°F
  - Flash Point: 400°F
  - Viscosity: 150 SUS @ 160°F
  - Viscosity Index: 100
- Anti-foam agent recommended
- Recommended Level: With all cylinders extended, there should be at least a 3-inch oil level in bottom of the tank.

HYDRAULIC SYSTEM OIL TANK CAP
- Clean every 50 hours
If oil flows out, the piston leather cups or packing are leaking and should be replaced. If no oil flow is present, tilt cylinder is O.K. Check for pressure loss due to leaks or worn-out pump.

BLEED HYDRAULIC SYSTEM

Air in the hydraulic system is indicated by uneven and bumpy operation of the lift equipment. The system can be bled of air by loosening the bleed screw at top of lift cylinder and operating control valve levers. Bleed system until air and foam are expelled and a clear stream of oil is apparent. Then close bleed screw tightly. Check operation of lift equipment and repeat bleeding process if operation is not satisfactory.

After bleeding process is completed, make certain bleed screw does not leak and recheck oil level in supply tank.

HYDRAULIC SYSTEM OIL LEVEL

To inspect oil level, operate control levers until all cylinders are fully extended, then check level of oil in tank. There should be at least a 3-inch oil level in bottom of tank.

HYDRAULIC PUMP

DESCRIPTION

The pump used in the LT35 hydraulic system is of the pressure-loaded gear type, consisting of aluminum alloy body and covers, steel gears, lead-bronze bearings, oil relief valve, and necessary seals.

The pressure-loaded principle used in construction of this pump is a patented design used exclu-
When the lift control lever is pulled back, oil is pumped through the control valve and lift cylinder connection. Oil pressure, applied to the bottom of the lift cylinder piston, raises the piston and lifts the mast carriage and load.

When the lift control lever is pushed forward, oil pressure on the lift cylinder is released and the mast carriage is lowered under the pressure of the load and the weight of the lift equipment itself.

When the control valve tilt lever is pushed forward, oil is pumped through the control valve and rear tilt cylinder connection. Oil pressure, applied to the rear of the piston, pushes the piston rod forward and tilts the mast forward.

When the tilt control lever is pulled back, oil is pumped through the control valve and front cylinder connection. Oil pressure, applied to the front of the piston, pushes the piston rod back. The piston rod pulls the mast back to a vertical position or tilts mast backwards if desired.

Control Valve Operation. There are two plungers in the control valve: One controls the tilting action and the other controls the lifting action. Check valves are mounted within each plunger. These check valves retain mast in the desired tilt position and mast carriage in the desired lift position when the control levers are returned to the neutral position.

A relief valve, also located in the control valve, "blows off" when mast reaches maximum tilt or when carriage reaches maximum lift position.

TROUBLE SHOOTING

HOSTILS WILL NOT LIFT LOAD

Load Too Heavy. Do not exceed maximum load limits. See rated capacity on Serial Number plate adjacent to Instrument Panel.

Pump Inoperative. Check pump as follows: Start engine. Remove hydraulic oil tank cap. Operate lift control lever. If no surging action of the oil is noted, oil pump is not working. If surging action is present, inspect relief valve as outlined below.

Oil Tank Outlet Clogged. Drain and inspect outlet for obstruction.

Relief Valve Sticking Open. Remove relief valve and inspect for dirt or other foreign substance that may cause valve to stick.

HOSTILS OPERATES UNEVENLY

Air in Hydraulic System. Inspect oil level in tank. With all cylinders extended, there should be at least a 2-inch oil level in bottom of tank. If level is low, air will enter the hydraulic system. Inspect for leaks at pump to tank intake connections. If leaks are present in the intake line, air will enter the system. After cause of air entering system has been remedied, bleed system by loosening bleed screw at top of lift cylinder. Recheck oil tank level.

MAST TILTS TOO SLOW

Tilt Cylinder Piston Cups or Packing Leaking. Check as follows: Tilt mast to the extreme forward tilt position. Disconnect hose at the tilt cylinder front connection. While holding the control lever in the forward tilt position, check for oil flow through the disconnected end.
## Specifications

### Engine
- **Make**: Continental
- **Type**: L-head
- **Model**: N92
- **Number of cylinders**: 4
- **Bore**: 2-3/8""
- **Stroke**: 3-1/2""
- **Displacement**: 62 cu. in.
- **SAE horsepower rating (license date)**: 9.25 HP
- **Brake horsepower at 2000 RPM**: 15.6 BHP
- **Compression ratio**: 6.46:1
- **Governed speed**: 2300 to 2500 rpm
- **Compression pressures**: Approx. 90 lbs.
- **Maximum variation between cylinders**: 10 lbs.

### Crankcase
- **Journal Diameter**: 1.7460 to 1.7465
- **Front**: 1.7460 to 1.7465
- **Rear**: 1.2460 to 1.2465

### Connecting Rod
- **Connecting rod journal diameter**: 1.499 to 1.500

### Valves
- **Intake**:
  - Type: Conventional Poppet
  - Tappet clearance: .012 (hot)
  - Seat angle: 45 deg.
  - Guide ream: .316 to .3167
  - Guide to stem clearance: .0005
- **Exhaust**:
  - Type: Roto
  - Tappet clearance: .012 (hot)
  - Seat angle: 45 deg.
  - Guide ream: .315 to .3167
  - Guide to stem clearance: .0005

### Oil Pressure
- **At normal operating speed**: 15 to 30 lbs.

### Pistons
- **Cast Iron**:
  - Piston to cylinder clearance: .0010 to .0015
  - Pull on .003" feeler
  - For checking clearance: 10 to 15 lbs.
- **Aluminum Piston to cylinder clearance**: .0025 to .0025
  - Pull on .003" feeler
  - For checking clearance: 10 to 15 lbs.

### Piston Pins
- **Pin to cast iron piston clearance**: .0002 to .0003 (loose)
- **Pin to aluminum piston clearance**: .0004 to .0005 (loose)
- **Pin to rod bushing clearance**: .0000 to .0005 (loose)

### Compression (top rings)
- **Number per piston**: 2
- **Type**: Taper
- **Width**: .0225 to .0235
- **End gap**: .0007 to .015
- **Side clearance**: .0015 to .003

### Oil (lower ring)
- **Number per piston**: 1
- **Type**: Slotted
- **Width**: .016 to .0165
- **End gap**: .007 to .015
- **Side clearance**: .001 to .0025

### Fig. 69. Hydraulic Lines & Fittings

**Description**
- The lift equipment is operated by means of hydraulic pressure. The system consists of an oil supply tank, oil pump coupled to the crankshaft pulley, control valve, single acting lift cylinder, double acting tilt cylinder, mast and carriage assembly, and necessary hydraulic connections. The tilt cylinder is attached to a bracket at the center of the frame and to the lift cylinder. The mast assembly pivots on a shaft mounted on the drive axle carrier.

**Operation**
- **Lift and Tilt Operation**: In operation, the oil pump maintains a constant hydraulic pressure at the control valve.
TROUBLE SHOOTING

This section is included to assist in the location and correction of troubles that may be encountered in operation of the engine. The trouble symptoms are shown as main headings. Under each heading the probable causes are listed in a recommended sequence of checking.

ENGINE WILL NOT START

Make certain ignition switch is turned "on", that fuel shutoff valve is opened, and that the tank contains fuel. If these items are O.K., check for faulty ignition.

Faulty Ignition. Disconnect one spark plug wire and hold end of wire 3/8 inch from any convenient ground. With ignition switch "on", crank engine with starting motor and check for spark. If spark occurs, check fuel system as outlined below. If no spark occurs, check distributor as follows:

Remove distributor cap and inspect cap for moisture or cracks and rotor for defects. Replace defective items. Inspect points for burned condition and correct gap clearance. If points are burned, replace points and condenser. If points are O.K., turn ignition switch on, break contact points and check for spark. If no spark occurs, check wiring to distributor. If spark occurs, distributor is O.K. Reassemble distributor and check coil as follows:

Remove coil wire at center of cap. Hold wire 3/8 inch from convenient ground and crank engine with starting motor. If weak or no spark occurs, replace coil. If spark occurs, replace and check spark plugs.

If entire ignition system is O.K., check for faulty fuel systems.

Faulty Fuel System. Disconnect fuel line at carburetor. If fuel does not flow, check fuel shutoff valve to make sure it is open, then check lines for clogged condition. If fuel flows freely, remove filter bowl and check for water or other foreign substance which may be in the fuel. If foreign substance is present in fuel system, drain and clean entire fuel system and add clean gasoline.

ENGINE MISFires

Check all wiring and battery cables for loose connections. Check fuel system for leaks. If these items are O.K., check vehicle as outlined below:

FAULTY ENGINE PARTS OR IGNITION SYSTEM.
Tune engine as outlined in the engine section of this manual, if misfiring still occurs, check for faulty fuel system.

FAULTY FUEL SYSTEM. Disconnect fuel line at carburetor and check for free fuel flow. If flow is erratic, blow out lines. Clean fuel filter and note whether water or other foreign substance is present.

If fuel is dirty or contains foreign substance, drain and clean entire fuel system and refill with clean gasoline.

ENGINE DOES NOT DEVELOP FULL POWER

Engine Speed Governor Too Low. Inspect governor controls and adjustment (See Fuel Section).

Engine Parts or Ignition System Faulty. Tune engine (See Engine Tune-up Section directly following this Trouble Shooting Section).

Incorrect Valve Timing. Check valve timing (See Engine Section).

Fuel System Faulty. Disconnect fuel line at carburetor and check for full and free fuel flow. Check carburetor float level (See Fuel Section).

Incorrect Valve Timing. Check valve timing (See Engine Section).

ENGINE OVERHEATS

Lack of Water in Cooling System. Be sure that radiator is filled with water. Inspect for leaks that have caused water level to fall.

Loose Fan Belt. Check for loose fan belt (belt should have 1/2 inch finger deflection between pulley centers).

Restricted Core Air Passages. Blow dirt out of radiator fins.

Clogged Cooling System. Clean cooling system (See Cooling Section).

ENGINE USES TOO MUCH OIL

Oil Leaks. Inspect for oil leaks. Pay particular attention to oil pressure gauge flexible hose.

Excessive Wear of Piston Rings. Inspect engine condition with compression test (See Engine Tune-Up Section).

Excessive Wear of Valve Guides. Inspect valve guides for excessive wear. Excessive clearance between intake valve stem and guide will cause the vacuum in the intake port to suck oil through the excessive clearance and into the combustion chamber where it will burn and cause excessive oil consumption. Replace worn guides.

REPAIR AND REPLACEMENT

ENGINE TUNE-UP

The following tune-up procedures are designed and recommended as a guide to maintain peak engine performance (at a high standard of efficiency). They include simple adjustments, inspections, and tests and are outlined in a recommended sequence for performing an engine tune-up.
Clean and Adjust Spark Plugs. Blow dirt from spark plug wells, then remove plugs. Clean carbon deposits from inside of plugs by sand blasting and wipe off porcelain with clean cloth. Inspect for cracked or broken porcelain insulators, burned electrodes, or excessive carbon deposits. Replace faulty plugs. Adjust electrode gap to .020 inch, using round feeler gage. Test compression before reinstalling plugs.

Test Compression. Make compression test with all spark plugs removed, and with choke and throttle wide open. Insert compression gage in a spark plug hole and rotate engine with starting motor until the maximum compression reading is obtained. Repeat this process for each cylinder. If the readings do not vary more than 10 pounds, compression pressures may be considered normal. If the readings vary more than 10 pounds or are extremely low, the valves, pistons, or rings may be faulty. An extremely low reading in two adjacent cylinders may indicate a blown-out cylinder head gasket.

Clean and Adjust Distributor Points. Remove distributor cap and rotor. Wipe dirt from cap and inspect cap and rotor for cracks. Clean points with file. Replace point set if points are pitted or burned.

NOTE: If points are burned or badly pitted, replace the condenser as it is probably the cause of these conditions.

After cleaning or replacing points, be sure point contacts are in perfect alignment, then adjust gap to .020 inch with a flat feeler gage.


Inspect Wiring. Inspect wiring for chafed or frayed insulation and loose connections.

Clean and Inspect Battery and Cables. Wash battery and cable terminals with clean water. Remove corrosion from cable terminals and battery posts with wire brush. Inspect cable insulation for defects and terminals for looseness. Replace faulty cables and tighten loose connections. Inspect battery electrolyte level and test battery charge.

Tighten Cylinder Head and Manifold. Tighten manifold nuts. Tighten cylinder head nuts evenly and in correct sequence. (See Cylinder Head Gasket in this section).

Clean Fuel Filter. Remove and clean filter bowl. Unscrew filter element with fingers and clean with compressed air. NOTE: Do not use pliers when removing or installing element or it will be damaged.

Clean and Lubricate Air Cleaner. See Lubrication Section.

Inspect and Adjust Valve Clearances. Inspect and adjust valve clearances if necessary. Recommended clearances for both intake and exhaust valves are .012 inch (hot).
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Remove Engine Assembly. (See Figures 7 and 8 for identification of items listed below).

1. Drain oil and water.
2. Remove seat.
3. Disconnect battery cable and remove battery.
4. Remove left side hood panel and tie plate.
5. Disconnect steering column upper bracket.
6. Close shut-off valve at filter then disconnect and remove fuel line.
7. Disconnect horn wire from starting motor solenoid switch.
8. Disconnect clutch linkage.
9. Disconnect accelerator linkage.
10. Disconnect air cleaner hose at carburetor.
11. Disconnect upper radiator hose at engine.
12. Remove muffler and pipe as an assembly.
13. Remove screws from bottom of hydraulic pump mounting bracket and slide pump as far as possible away from pump coupling.
14. Remove screws holding fan bracket to engine block and slide fan and belt assembly away from engine.
15. Remove one screw from coil bracket and pivot coil to one side.
16. Remove screws fastening instrument panel to center partition.
17. Remove lower center partition.
18. Disconnect lower radiator hose at engine.
19. Remove No. 4 spark plug and install an eye-hook in this hole. Connect chain hoist to eye hook. The engine will be correctly balanced if lifted from this point.
20. Remove screws fastening engine to floating plate.
21. Raise engine slightly and move it towards radiator to disconnect universal joint splined yoke from clutch shaft. Raise engine up and out of chassis.

Install Engine Assembly.
1. With eye-hook installed in No. 4 spark plug hole and attached to a chain hoist, lower engine into chassis enough so that clutch shaft will engage into universal joint splined yoke. With yoke connected to clutch shaft, lower engine completely and fasten to the floating plate.
2. Connect lower radiator hose.
3. Install lower center partition.
4. Fasten instrument panel to center partition.
5. Fasten coil to engine.
6. Engage hydraulic pump shaft with coupling and fasten bracket to floating plate.
7. Install fan assembly and belt. Adjust belt deflection.
8. Install muffler and pipe assembly.
9. Connect upper radiator hose.
10. Connect air cleaner hose.
11. Connect clutch linkage and adjust pedal free play.
12. Connect accelerator linkage.
13. Connect horn wire to starting motor solenoid switch.
15. Connect upper steering column bracket.
16. Install tie plate and left side hood panel.
17. Install battery and connect cables.
18. Install seat.
19. Fill crankcase with 3-1/2 quarts of engine oil. Fill cooling system with water or antifreeze solution. Before starting engine, read the following paragraphs on "Break-in Procedure after Engine Overhaul".

BREAK-IN PROCEDURE AFTER ENGINE OVERHAUL

Make certain oil and water levels are correct, then start engine and accelerate it to a fast-idle (approximately 1000 rpm). Immediately after starting, check for correct oil pressure (15 to 20 pounds) and listen for any unusual noise which may indicate faulty operation of engine parts.

Keep engine operating at fast-idle speed during the warm-up period. Reset choke during the warm-up period to assure smooth engine operation and prevent over-chooking.

Operating an engine at idle speed will not provide adequate lubrication for the newly fitted cylinders, rings and pistons and may result in scuffing. Over-chooking will wash the lubricating oil off the pistons and rings and will cause oil dilution.

New engines can be subjected to normal load after the engine temperature is up to normal. Overhauled engines should be operated at fast idle speed for a period of 2 hours before the lift truck is used for carrying loads.

On both new or overhauled engines, change engine oil after the first 25 hours operation. Thereafter change the engine oil each 50 hours of operation.

CYLINDER HEAD GASKET

A faulty cylinder head gasket may be indicated by the following troubles: engine missing, extremely low compression pressures in adjacent cylinders, loss of water from radiator, or staining of water through muffler.
Replace faulty gasket as described below.


Clean Carbon and Inspect. Clean carbon from cylinder head and block, using carbon scraper and wire brush. Inspect head and block for cracks or excessive erosion of water passages. Always install new gasket when head has been removed.

Install. Place head gasket on block with side marked TOP up. If gasket is not marked, install with seams on top. Install cylinder head, washers, and nuts. Using a torque wrench, tighten head nuts evenly and in correct sequence (Figure 9) at 60 to 65 foot-pounds pressure.

Clean, adjust, and install spark plugs. Connect plug wires. Install upper hose, close drain cock, and fill cooling system with water or anti-freeze. Start engine, then inspect for water leaks and observe engine performance. Retighten cylinder head nuts when engine is hot.

**VALVES**

This engine is equipped with conventional poppet-type intake valves which are secured to the springs with pins. The exhaust valves are of the Roto type. This requires a special valve, retainer, and a cap that slips over the end of the valve stem. With this construction the valve stem makes no contact with the tappet screw; contact is between valve cap and between cap and adjusting screw. The use of this type construction results in a rotary movement of the exhaust valve as it opens, helping to keep valve seat free of carbon and to prevent valves from sticking in the guides.

Remove Valves. Remove carburetor air cleaner, carburetor, cylinder head, and valve covers. To remove intake valve, compress spring and tap valve down with a wood block or hammer handle, then remove retainer pin. To remove exhaust valve, compress spring to raise the valve, then remove valve cap. Tap valve down with a wood block or hammer handle, and remove keys.

To remove spring, compress spring until the retainer clears tappet screw. Slide spring and retainer off lifter (Figure 11) and remove spring.

Clean and Inspect Valves. Clean carbon deposits from cylinder head, valves, top of pistons, and cylinder block. Inspect valve seat and valve facing; if pitted or burned, replace valves and seats. Inspect for best valve stem or incorrect fit of stem in guide. Recommended stem to guide clearance is .0035 inch. Replace defective parts. If a new valve is used, and stem to guide clearance is excessive, install a new guide. When new guide is installed, reface valve seat.

Replace Valve and Seat. Recondition valves on a valve refacing machine. Set machine at 45-degree angle for intake and exhaust valves. Do not burn face of valve or remove more material than is necessary.

**BRAKES**

**DESCRIPTION**

Model LT75 is equipped with a band type brake mounted on the transmission. The brake is operated through levers and a cam, by a foot pedal. A ratchet, attached to the foot pedal, engages a pawl and holds the pedal down in the applied position to provide a parking brake for the vehicle.

**ADJUSTMENT**

Adjust Brakes. Adjust band to drum clearance by loosening pedal to operating lever bolt and nut, and changing position of pedal on lever.

**REPAIR AND REPLACEMENT**

Replace Brake Band and Drum. Disconnect pedal return spring. Remove cotter pins from band clamp pins. Remove pins and clamps. Remove cotter pins and strap from anchor pins, then remove brake band.

The early model vehicles were equipped with metallic brake lining which was later changed to a molded lining bonded to the brake band. If lining is worn, replace band assembly using the new style molded band assembly. If the vehicle was originally equipped with metallic lining, other parts must be replaced to make the molded brake band interchangeable (Refer to Parts List Brake Section).

Do not refrain. If lining is worn, replace brake band assembly. With brake band removed, inspect drum for scoring. Replace a scored drum.

Before installing band, apply a light coating of grease to anchor pin and clamp-to-band contact surfaces. Install band and secure to anchor pins with strap and cotter pins. Compress ends of brake band and install clamps and pins. Secure pins with cotter pins. Connect pedal return spring and adjust band to drum clearance.

**Lubricate Brake Linkage.** All friction surfaces in brake linkage should be lubricated with a few drops of engine oil each week of operation.
necessary to eliminate burned or pitted areas. Cut the valve seats with a seat cutter or grinder (45 deg.). If cutting enlarges the valve seat to more than 3/32 inch, grind or cut top surface of valve seat, using a 15-degree stone, to narrow the seat to width of 3/32 inch. After conditioning the valve and seat, inspect run-out, using a dial indicator; run-out should not exceed .002 inch. Remove excess dust from cylinder block, valve guides, and parts with clean, dry compressed air.

Grind Valves. Lap valves lightly to seats, using a good valve grinding compound. If a true seat contact is not accomplished by turning grinder a few turns, inspect valve and seat run-out and angle. After grinding, be sure to remove all compound from valves, seats, and cylinder block.

Replace Valve Guides. Before removing valve guides, measure the distance from the top of the guide to the top surface of the cylinder block for identification upon reinstallation. Tap guides out of cylinder block with a pilot drill. NOTE: If guide is to be removed with camshaft and lifters installed, and suitable puller is not available, break the guide as it is driven out of the cylinder block.

Drive guide, small outside diameter end down, in cylinder block, using a pilot drill. Drive guide until the distance between top surface of cylinder block and top of valve guide is 25/32 inch. After installing guides, inspect valve stem fit in guide, and ream if necessary. Recommended guide to stem clearance is .0030 inch.

Install Valves. With tappet in the closed valve position, and retainer in place on spring, position valve spring on stem guide. Compress and slide spring on tappet, using a valve spring compressor (Figure 11). Coat valve stem with engine oil and install intake valves in their correct valve guides in cylinder block.

To install intake valve, compress spring and insert retainer pin in stem (Figure 10). Be sure that the spring seats correctly on guide, and that pin engages retainer fully.

To install exhaust valve, compress spring and position valve cap on tappet screw as shown in Figure 12. Tap the valve down until groove in valve stem is between cap and spring retainer. Place keys in a key inserting tool similar to that shown in Figure 13, then install keys and release the valve spring. Adjust tappet clearance (par. below) and install cylinder head, valve covers, carburetor, and air cleaner.

Adjust Tappet Clearance. Adjust both intake and exhaust valve tappet clearance to .012 (.011). Loosen tappet screw lock nut and adjust as shown in Figure 13.

PISTON AND RINGS

Engine Serial No. N92-13098 or below are equipped with cast iron pistons. Engine Serial No. N92-13099 or above are equipped with special cam and taper ground aluminum pistons. Both pistons are equipped with three rings (one oil ring in the bottom groove - two compression rings in the two top grooves); rings for cast iron and aluminum pistons are interchangeable.
The aluminum and cast iron pistons are interchangeable as a complete set. When replacing pistons, it is recommended that aluminum be used. When using aluminum pistons as a replacement, it is recommended that standard or specific oversize be ordered and that the piston and pin assembly be used. It is difficult to find a source that can correctly "cam and taper grind" a semifinished piston to the desired specifications and the size of the piston pin (.6635 - .6645 diameter). Warranties use of an uncommon size pilot reamer for fitting pin to piston. If engine uses an excessive amount of oil, it is recommended that the engine assembly be removed and repaired as outlined below.

**Replace Levershaft Oil Seal and Bushing.** (Figure 6a). Pry old oil seal out of housing. Press bushings out of housing, using an arbor press.

When installing bushings, place bushing with partial oil groove in outer end of housing and with groove open and pointing toward inside of housing. Inner bushing has oil groove completely across bushing surface. Press bushings in housing, using arbor press. Line rear bushings until levershaft rotates freely and clearance between bushing and levershaft does not exceed .002 inch.

Before installing oil seal, make certain leather is soft and pliable. Place oil seal gasket in housing, then press seal in housing until it is firmly seated on gasket.

**Install Cam and Wheel Tube.** Cost bearings with lubricant and insert cam in housing. Install shims, cover, and screws. Rotate wheel tube so the arrows are tightened to correctly position the bearing balls. Adjust cam bearings and install jacket and clamp. Do not install steering wheel until steering gear assembly has been installed in vehicle.

**Install Levershaft.** Insert levershaft in bushings, meshing studs with cam threads. Loosen adjusting screw in housing side cover, then install gasket and side cover, and secure with screws and copper washers. Adjust levershaft shud to cam bushing.

**Install Steering Gear and Wheel.** Position steering gear assembly for mounting in chassis and install mounting bolts and nuts. Install top body cover and fasten jacket clamp to cover. Place jacket bearing spring seat and spring on wheel tube. Install steering wheel and secure with nut. Place spring seat and spring on wheel tube and install horn button base plate and retaining screws.

With insulating ferrule assembled to horn cable, insert cable through hole in wheel tube.

With contact cup, spring, and cap correctly positioned in horn button, place button in steering wheel. Depress and twist button until rubber lugs on base plate engage horn button lugs. Connect drag link to Pittman arm.

**DRAG LINK**

Adapt Drag Link. Remove cotter pin from end of drag link. Tighten slotted pin firmly against ball, back off one-half turn, then to nearest cotter pin hole. Install cotter pin. Adjust both ends of drag link in the same manner.

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**Fig. 57. Drag Link - Exploded View**
when rotating wheel with thumb and forefinger.

Adjust Lever Shaft Blacklash. Turn steering gear wheel until steering axle wheels are in a straight-ahead position. Loosen adjusting screw lock nut at gear side cover (Figure 64). Tighten adjusting screw until there is a slight finger drag when turning steering gear wheel slowly from one extreme to the other. Tighten lock nut after correct adjustment is obtained.

STEERING GEAR REPAIR AND REPLACEMENT

Remove Steering Wheel and Gear. Disconnect horn button cable and remove terminal at end of cable. Depress and twist horn button, then lift button out of steering wheel. Withdraw horn cable from wheel tube. Remove screws fastening horn button base plate and remove plate, spring, and spring seat. Unscrew steering wheel nut and remove wheel, using a puller.

Remove top and side body plates. Disconnect drag link. Remove bolts and nuts fastening steering gear housing, then remove steering gear assembly.

Remove Lever Shaft. Remove Pitman Arm. Remove side cover screws and washers. Remove cover

Fit Piston Rings. Insert ring in cylinder, square the ring in the cylinder with head of piston, then measure gap with a flat feeler gauge (Figure 14). Clearance of .007 to .015 inch is recommended for both compression and oil rings. If clearance is excessive, replace ring. If clearance is under specification, file rings by filing edges, using a mill file (Figure 15). Measure ring side clearance in piston groove with a flat feeler gauge (Figure 16). Recommended clearance is .0015 to .006 inch. If ring does not fit correctly, replace ring or piston. Be sure ring groove is clean and free of carbon when measuring groove clearance.

Assemble Piston and Connecting Rod. Before assembling piston and connecting rod, inspect ring and clearance, pin fit, and connecting rod alignment. Items to be assembled should be heated to room temperature (200°F).

With connecting rod positioned in piston, install pin and lock rings. Inspect for free movement of rod and piston on pin. Connecting rod should turn on pin under its own weight. Place oil ring in piston bottom groove and compression rings in both top grooves.

Install Piston and Connecting Rod Assembly. Before installing, make certain all parts and cylinder walls are clean. Dip assembled piston into can of good grade engine oil and coat cylinder wall with clean engine oil.

The pistons must be installed from the bottom of the cylinder. The bottom of the cylinder is chamfered, eliminating compressing of the rings with an additional tool.

To install piston, square piston with cylinder, shake piston sideways slightly, at the same time applying slight pressure to push piston into cylinder (Figure 17). Position bearing inserts (two engaging slots and oil hole aligned with connecting rod oil hole) in cap and rod. Install bearing cap and tighten nuts at 35 to 40 foot-pounds pressure, using a torque wrench. Set nut locks. Install cylinder head and oil pan.
CONNECTING RODS AND BEARINGS

The connecting rods are provided with shell insert type bearing. These bearings are easily replaced by removing the oil pan and bearing caps. New bearings do not require reaming. The following procedures deal with replacement of connecting rods and bearings with engine removed.

Remove Connecting Rod and Bearings. See Piston and Ring Section.

Inspect Connecting Rod and Bearings. Inspect for pitting, scoring, or excessive wear of crankshaft journals and connecting rod bearings. Inspect crankshaft journals for out-of-round or taper. Taper or out-of-round should not exceed .001 inch. Inspect connecting rod alignment, using correct fixture. Recommended maximum twist and end of rod is .002 to .003 inch.

Inspect Connecting Rod Bearing Clearance. Connecting rod bearings are shell inserts, and should not be altered to obtain correct fit. Replace bearings if clearance is not within specifications. Recommended clearance is .0015 to .002 inch. Inspect clearance by placing a steel gage .002 inch brass shim (1/4 inch wide x 1 inch long) between bearing and journal. Tighten connecting rod cap at 30 to 40 foot-pounds; rotate crankshaft. If there is still resistance to turning, bearing clearance is not excessive. Use undersize bearings of the correct size if clearance is excessive.

Install Connecting Rod and Bearings. See Piston and Ring Section for installation of connecting rod. Before installing bearings, be certain connecting rod bearing seats are clean, and also wipe off back side of bearings. When installing bearings, make certain that bearing lugs engage slots and that oil holes are aligned. (See Figure 17). Tighten bearing cap screws at 35 to 40 foot-pounds pressure, using a torque wrench. Bearing caps should not be filed or distorted in any way.

CRANKSHAFT AND MAIN BEARINGS

The crankshaft is supported by two shell insert type main bearings. When replacing bearings, use undersize bearings of the correct size. Do not file cap or bearing to obtain correct fit. The following procedures cover replacement of crankshaft and bearings with engine removed.

Remove Crankshaft and Main Bearings. Remove engine assembly (See Section on Engine Assembly). oil pan, clutch, flywheel and housing, crankshaft pulley, timing gear cover. Remove connecting rod and main bearing caps. Remove crankshaft gear, thrust plate, and thrust washer from front of crankshaft. Remove retainers and seal from rear of crankshaft. Then lift crankshaft out of crankcase.

Inspect Crankshaft and Main Bearings. Inspect for scoring or excessive wear of crankshaft journals and bearings, and for plugged oil holes in crankshaft. Inspect journals for out-of-round or taper. Taper or out-of-round should not exceed .001 inch.

Install Crankshaft and Main Bearings. Place upper crankshaft bearings in their correct positions in cylinder block. Be sure bearing oil holes are aligned with the holes in cylinder block. Bearing lugs should rest in slots in cylinder block. Coat bearings with...
STEERING AXLE WHEELS

Adjust Wheel Bearings. Remove hub cap and bearing nut cotter pin. Tighten bearing nut as much as possible, turn nut back one slot, then to nearest cotter pin slot and install cotter pin. Rotate wheel while adjustments bearings.

Lubricate Wheel Bearings. Each six months the wheels should be repacked with new grease. Remove hub cap, cotter pin, bearing nut, key washer, and outer bearing cone from wheel hub. Remove wheel, tap inner bearing cone and oil seal out of hub, using a brass drift. Remove oil lubricant, then repack bearing cones and hub with a good grease (See Lubrication Section).

Place inner bearing cone in hub and install new oil seal. Install wheel, outer bearing cone, key washer, bearing nut, and adjust bearings. Install cotter pin and hub cap.

engine oil, slide one thrust washer on end of crankshaft, then position crankshaft in bearings and cylinder block. With lower bearings in cap, lug correctly aligned with cap slots, install bearing caps and inspect fit of bearings to crankshaft journal (par. below). Tighten bearing cap nuts evenly at 100 to 110 foot-pounds pressure, using a torque wrench. Install two nuts, positions as shown in Figure 14.

Slide thrust washer on end of crankshaft and position washer on dowel pins. Insert key in crankshaft slot and install shims, thrust plate (hub out), crankshaft gear, oil slinger, and pulley on front end of crankshaft. Secure pulley with screw and washer and inspect crankshaft end play (see par. below). With crankshaft end play correct, remove pulley.

Connect connecting rod bearings with oil and install bearings and caps. Install a new oil seal in timing gear cover, then install cover. Before tightening cover screws, install pulley to assure correct alignment between pulley and oil seal. Tighten cover and pulley screws. Install a new oil seal in crankshaft rear seal retainer, then install retainer and gasket.

Install strainer screen, oil pan and gasket, flywheel and housing, and clutch. Install engine assembly in vehicle.

Inspect Crankshaft Main Bearing Clearances. Crankshaft bearings are shell inserts. The caps and bearings should not be altered to obtain correct fit. Replace bearings if fit is not within specifications. Recommended clearance is .0015 to .002 inch.

Inspect clearance by placing a well oiled .002 inch brass shim (1/4 inch wide x 1 inch long) between bearing and journal. Tighten crankshaft bearing cap at 100 to 110 foot-pounds, using torque wrench. Rotate crankshaft. If there is a stiffness resistance to turning, bearing clearance is not excessive.

Inspect and Adjust Crankshaft End Play. Crankshaft end thrust is taken by the front bearing shoulder, thrust washers, and plate, and is adjusted by removing or installing shims between timing gear and crankshaft shoulder. To inspect crankshaft end play, pry crankshaft toward flywheel using a flat feeler gauge inserted between journal and bearing shoulder. End play of .0025 to .005 inch is recommended.

CAMSHAFT AND TIMING GEARS

The camshaft is supported by three bearings machined directly into the crankcase (no serviceable bearings are required). Two helical timing gears are used, one on the camshaft and one on the crankshaft. The camshaft gear is reseated and an automatic governor is mounted in this recess (Figure 19). No internal adjustment of this governor is necessary (See Fuel Section for external governor adjustment).
Inspect and Adjust Valve Timing.

If the timing gears are removed, valve action must be timed in relation to piston position when reassembling. Two teeth on camshaft gear and one tooth on crankshaft gear are punched-marked. Install timing gears so that marked tooth on crankshaft gear engages the two marked teeth on camshaft gear. If assembled in this manner, the camshaft is timed correctly.

To inspect gear marks or adjust camshaft timing when gears are not marked, adjust No. 4 cylinder tappet clearance so that a .020 feeler will pass freely and a .021 feeler will be tight. Rotate crankshaft until "T.D.C." mark on flywheel aligns with pointer. Rotate camshaft counterclockwise until No. 4 cylinder exhaust valve is open; continue to rotate camshaft slowly until valve just closes. With camshaft and camshaft in these positions, the marked gear teeth should match. With camshaft and camshaft in these positions, No. 1 cylinder is at T.D.C. on the compression stroke, so distributor may be set to fire No. 1 cylinder.

OIL PUMP and STRAINER

A gear type oil pump is mounted on the rear of the cylinder block and is coupled to the end of the cam.

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STEERING AXLE and WHEELS

The steering axle is located at the rear of the vehicle and is attached to the chassis with a spring (Figure 62). Steering control points are pivoted on roller and needle bearings. The steering axle wheels are mounted on tapered roller bearings.

DESCRIPTION

The steering axle is located at the rear of the vehicle and is attached to the chassis with a spring (Figure 62). Steering control points are pivoted on roller and needle bearings. The steering axle wheels are mounted on tapered roller bearings.

REPAIR AND REPLACEMENT

Replace Axle Assembly. Raise vehicle frame until wheels just rest on floor. Remove shackle bolt. Disconnect drag link at steering knuckle arm. Raise vehicle higher and remove axle and spring assembly.

To install axle, raise vehicle, position flat end of spring in bracket. Lower vehicle, align spring eye with shackle bracket, and install shackle bolt. Connect drag link.

Replace Steering Knuckle and King Pins. On early model axles, the steering knuckles are attached to the king pins with a self-locking nut. On later models, the knuckles are welded to the king pin. The king pin and knuckle assembly can be removed by unscrewing the flax head screw at the top of the king pin.

ADJUST TOE-IN

Adjust Toe-In. Adjust wheel toe-in to 0 to 1/8 inch by loosening lock nuts and turning tie rod.
shaft (Figure 21). The strainer for the oil pump is attached to the bottom of the crankcase as shown in Figure 18. The oil pump draws oil through this strainer and through oil holes drilled in crankcase, then pumps it through other passages to the various moving parts.

Remove and Disassemble Pump.

To remove the pump, it is necessary to remove clutch and flywheel. Then remove screws fastening body to block.

Inspect Pump

Inspect gears and surfaces on which gear faces contact for wear and scoring. Inspect shafts and bushing for scoring and wear. Replace defective parts. The bushing in the pump body is serviced only with the pump body assembly.

Assemble and Install Pump. When installing pump, use a lead gasket between body and cover and a "treated-paper" gasket between cover and cylinder block (Figure 21). Use copper washers on body screws. Tighten screws alternately and evenly to prevent damage to pump body.

OIL PRESSURE RELIEF VALVE

The oil pressure relief valve (Figure 22), which automatically controls maximum engine oil pressure, consists of a plunger and calibrated spring, and is located at the right rear of cylinder block adjacent to oil pump (Figure 21).

To remove relief valve, unscrew plug from cylinder block and remove spring and plunger. If oil pressure is higher than normal, valve plunger may be sticking. Remove plunger, clean thoroughly, and inspect for correct fit in crankcase hole. Replace defective parts. If oil pressure is lower than normal, pressure may be increased by installing small flat washers between plug and spring. Normal operating oil gage pressure is 15 to 20 pounds.
DRIVE AXLE

The drive axle differential is incorporated in the transmission assembly. For description and service procedures, see Transmission Section.

DRIVE AXLE WHEELS

Adjust Wheel Bearings. Remove hub cap and bearing nut cotter pin. Tighten bearing nut as much as possible to make certain bearing is seated correctly, then turn nut back to nearest cotter pin slot and install cotter pin. Rotate wheel while adjusting bearings.

Lubricate Drive Gears and Wheel Bearings. Each six months the wheel bearings and drive gears should be cleaned and repacked with new grease. Remove hub cap, cotter pin, bearing nut, key washer, and outer bearing cone from wheel hub. Remove wheel, tap inner bearing cone and oil seal out of hub, using a brass drift. Remove oil lubricant from bearings and drive gears, clean parts thoroughly; then repack cones and wheel hub with grease and coast gears with grease (See Lubrication Section).

Place inner bearing cone in hub and install new oil seal. Install wheel outer bearing cone, key washer, bearing nut, and adjust bearings. Install cotter pin and hub cap.

JACKSHAFT

Replace Jackshaft. Remove wheel assembly. Remove the screws fastening bearing cover and withdraw jackshaft assembly. Before reinstalling jackshaft, pack bearings with chassis lubricant. When reinstalling jackshaft, rotate shaft to align splines with transmission gear. Secure jackshaft with cover screws and wheel.

Replace Jackshaft Bearings. The gear end of the jackshaft is supported by two tapered roller bearing cones and one double cup. To replace bearings, straighten ears of nut lock, unscrew lock nut and bearing adjusting nut, then remove bearing cup, cones, and cover.

To install bearings, place bearing cover, one bearing cone, double cup, other bearing cone on jackshaft. Install and tighten bearing nut as much as possible to seat bearing, using a spanner wrench. Loosen nut until bearing can rotate on jackshaft by hand and no end play is present. Install lock and lock nut, then secure lock nut by bending lock ear over nut.
TAPPED BEARING  COUPLING PLATE  DRILLED BEARING

REPAIR AND REPLACEMENT

Disassemble and Remove Universal Joint. Remove lock wires and screws fastening 4 trunnion bearings to the coupling plate. Carefully pry bearings out of coupling plate retaining lugs and slide bearings off spider journals. Remove coupling plate.

To remove spider, remove screws fastening bearings to yoke. Pry bearing out of retaining lugs and remove spider and bearing assembly.

Assemble and Install Universal Joint. Pack the bearings with grease and place them temporarily on spider journals to remove excess lubricant. Reinstall the bearings and install new cork gaskets. Slide drilled bearings on spider journals and install assemblies on yokes. Insert coupling plate between the two spiders. Slide two tapped bearings on spider adjacent to transmission and two drilled bearings on spider adjacent to clutch shaft. Install screws through drilled bearings and coupling plate and into tapped bearings. After tightening retaining screws, secure them with lock wires.

YOKES  DRILLED BEARINGS

Fig. 60. Universal Joint - Installed View

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CLUTCH

Ref.
No.  DESCRIPTION

1  COVER
2  EYEBOLT and NUT
3  LEVER, release
4  PIN, release lever
5  PLATE, pressure
6  SPRING, anti-rattle
7  SPRING, thrust
8  STRUT, release lever
9  PLATE ASSEMBLY, driven
10  FACING and RIVET
11  SCREW, clutch cover
12  WASHER, lock, clutch cover screw

Fig. 23. Clutch - Exploded View

DESCRIPTION

The clutch (Figure 23) is a single plate, dry-disk type, self-compensating for facing wear; no adjustment within the unit is necessary unless clutch is disassembled. A clutch pedal adjustment is required (as the facing wears) to prevent the release bearing from riding on the levers and causing clutch to slip.

When the clutch pedal is depressed, the release bearing moves toward the clutch, contacts release levers, and releases the spring pressure on the driven plate, thus permitting the flywheel to spin freely. When the pedal is released, the bearing moves away from the levers, thus allowing spring pressure to be applied to the pressure and driven plates. This engages the entire clutch and power train with the engine flywheel.

REPAIR AND REPLACEMENT

CLUTCH PEDAL ADJUSTMENT

The clutch pedal should have 1 inch for travel before the release bearing contacts clutch release levers. Adjust pedal for travel by removing clevis pin, loosening lock nut, and turning yoke at release shaft lever.

CLUTCH REPLACEMENT

Remove Clutch. Remove left body plate and disconnect clutch linkage. Remove universal joint assembly and slide yoke off clutch shaft. Remove screws fastening bearing carrier to clutch housing. The clutch shaft assembly and release bearing can
Push shaft into driven plate until pilot end engages bearing in flywheel and bearing carrier is in correct mounting position in clutch housing. Fasten carrier with screws. Operate release lever by hand and check release bearing for operating freely until it contacts clutch release levers.

Install yoke and universal joint. Connect clutch linkage and adjust yoke until pedal has 1 inch free travel.

**CLUTCH REPAIR**

Inspect and Repair Driven Plate. Inspect driven plate facings for excessive wear (down to the rivet heads). If driven plate is worn, replace assembly. If driven plate is O.K. and facings are worn, the facings may be replaced. When replacing clutch driven plate, use new rivets and new facings of correct thickness, size, and material. Variation in thickness of facings will result in faulty clutch operation. CAUTION: Drill out facing rivets to remove them.

Disassemble Clutch Cover. Punch mark pressure plate lugs and cover so that cover and plate can be reinstalled in same relative position. The clutch

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**UNIVERSAL JOINT**

The drive between the transmission and clutch shaft consists of two cross and trunnion bearing universal joints coupled by a steel plate. The trunnion bearing is an assembly of steel rollers and a cup. Cork washers mounted in the cup prevent lubricant leakage and dust shields mounted on the spider journals keep out dirt. The universal joint must be disassembled for lubrication or repair.
Repair Oil Pump. To disassemble pump, remove cover screws and lift off cover and gasket. Remove gear and shaft assemblies from housing. Inspect gears and housing for wear. Replace worn gears. If housing is worn, replace pump assembly.

Before assembling pump, make certain oil passages are clean and free from any obstruction. Dip gears in oil when assembling pump. Install gear and shaft assemblies. Install gasket and cover and secure with screws.

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Fig. 54. Transmission Oil Pump - Exploded View

Fig. 26. Removing and Installing Release Levers

Remove Release Levers. Grasp the lever and eyebolt between thumb and fingers. With other hand, raise strut, tilt outward, and lower strut as shown in Figure 26. Then maneuver lever and eyebolt from strut and lug.

Inspect Clutch Cover, Parts. Inspect all parts for wear. Replace worn parts. Inspect for weak or broken springs. Place pressure springs on a flat surface and inspect for uniform height. Replace faulty springs.

Install Release Levers. Coat eyebolt base and floating pin with a thin layer of grease. Install pin in eyebolt and position assembly in lever socket. Place strut in lug ridge, grasp eyebolt and lever between thumb and fingers, and install in pressure plate lug as shown in Figure 26.

Assemble Clutch Cover. Make certain anti-rattle springs are fastened to clutch cover and that release levers are installed correctly. Place pressure springs on pressure plate bosses arranged as shown in Figure 27. Position cover on springs so that punch marks on lever lug and cover are aligned. Place cover assembly in arbor press with pressure plate positioned squarely on a block and with a wood block or bar across cover (Figure 25). Be sure that clutch cover eyebolt holes are clear. Compress cover slowly, keeping lever lugs and eyebolts aligned with their respective openings in the clutch cover. Install eyebolt nuts and tighten until they are flush with tops of eyebolts. Release press. Remove clutch cover assembly from press and adjust release levers. After levers are adjusted, punch nuts to lock them in place (Figure 28).

NOTE: Correct operation of the clutch depends upon adjustment of the release levers. These levers must all be adjusted equi-distant from the pressure plate machined surface. Use a clutch assembly fixture for adjusting clutch cover.
in case, engaging gears as shown in Figure 56. Install shafts and secure with set screws and lock wires. Install transmission cover and gasket.

Install Transmission Assembly. Position transmission assembly on drive axle carrier and secure with screws. Install gear shift levers, brake band, and connect universal joint. Fill transmission with three pints of engine oil (SAE 50, summer; SAE 30, winter).

**TRANSMISSION OIL PUMP**

The transmission is equipped with a gear-type oil pump mounted at the top of the transmission case (at side opposite gear shift levers). The pump is driven by a coupler which is threaded into the end of the bevel drive gear.

Two styles of pumps have been used—(See Figures 57 and 58). When replacing pump, use the latter model assembly and new style oil pipe.

**Replace Pump Assembly.** To replace the pump assembly, disconnect oil pipe and remove the screws fastening pump housing to the transmission case.

The coupler can be replaced by unscrewing it from the bevel drive gear.
carrier on brake drum side of case and wide carrier on oil pump side of case (Figure 50). Secure bearing carriers with screws and check differential for rotating freely without end play. Adjust bearing end play by removing or installing bearing carrier gaskets.

Install Reverse Idler and Countershaft Gears. Place reverse idler gear (small gear end toward oil pump) in transmission case. Insert spacers between each side of gear and case. Install packing rings in shaft groove and install shaft in case from brake drum side of case. Place countershaft gear (small gear end away from oil pump) in transmission case. Install shaft lock engaging lock ends with slots in reverse idler gear shaft and countershaft. Secure lock with screw.

Install First and Second Speed Sliding Gear. Install lock ring and tap bearing cone on plain end of shaft. Place gear (large gear end toward brake drum) in case and insert shaft in gear from oil pump side of case as follows: Place gear partially on shaft spline and insert spring and two lock balls in shaft hole. Hold spring compressed with two fingers and slide gear over balls and on shaft. Tap bearing cup in, then install gasket and bearing cover on oil pump side of case. Install lock ring and tap bearing cone on threaded end of shaft. Tap bearing cup and install cover on case. Check bearing adjustment. Shaft should rotate freely without end play. Adjust bearings by removing or installing bearing cover gaskets. Insert key in shaft slot, install brake drum, and secure with nut.

Install Bevel Drive Gear and Adjust Bearings. Install same shims that were removed when bearing was removed. This will assure correct tooth contact of gear and pinion. Press inner bearing cone on bevel gear shaft. Install bearing lock ring on shaft. Tap both bearing cups in case. Position forward and reverse sliding gear (large gear end away from oil pump) in case and insert bevel gear shaft spline partially into gear. Insert spring and two lock balls in bevel gear shaft hole. Hold spring compressed with two fingers and slide forward and reverse gear over balls and on shaft spline. Install lock ring, shims, and outer bearing cone on threaded end of shaft and secure with nut. Check bearing adjustment. Bevel gear shaft should rotate freely without end play. Adjust bearings by removing or installing shims between outer bearing cone and shaft splines. After bearings are correctly adjusted, install gear shift lever bracket and gasket. Do not install oil pump assembly until bevel pinion is installed. (See paragraph below.)

Install Bevel Drive Pinion Assembly and Adjust Backlash. Install shims, gasket, and pinion assembly. Secure pinion sleeve to case and check pinion to gear backlash which should be from .006 to .008 inch. The pinion assembly can be moved in or out to adjust backlash by removing or installing shims between transmission case and pinion bearing sleeve. These shims are available in sizes of .005, .003, .005, and .020 inches.

Install Shift Yokes. Install new shift yoke shaft seals in transmission case. Place shift yokes on first and second speed shift yoke.
CARBURETOR ADJUSTMENTS

Adjust Engine Idle. The idle adjusting screw controls the fuel mixture for the idling system. Turning the screw clockwise produces a leaner mixture and counter-clockwise provides a richer mixture. Adjust idle with engine warm. To adjust idle, turn adjusting screw clockwise until engine idles "rough", then turn screw slowly counter-clockwise until engine idles smoothly. The idle speed is adjusted by turning the throttle stop screw.

Adjust Carburetor Float Level. The carburetor must be disassembled to adjust float level. For correct float level, there should be 1-3/32 inch distance from the machined surface of the throttle body to the highest point at top side of float, with the throttle body in an inverted position (See Figure 29).

CARBURETOR REPAIR

Repair kits are available for repairing a carburetor or reconditioning one after it has been subjected to a long period of service. It is recommended that the carburetor be disassembled, inspected and repaired as outlined below.

Disassemble Carburetor. Remove screws fastening bowl to body. Carefully separate bowl from body as follows: Raise throttle body slightly, loosen gasket from the bowl, then lift throttle body and gasket assembly off bowl. Remove venturi.

Remove Float and Fuel Valve (Figure 30). Remove float axle, using a screw driver. First, push axle out slot end of bracket, then remove axle with fingers. Remove float and fuel valve needle. Un-screw fuel valve seat and gasket.

Remove Idle Screw and Jet. Unscrew idle adjusting screw from body and remove spring (Figure 30). The idle jet is located in a passage at center of the machined surface of the throttle body (Figure 31). Remove idle jet with small screw driver.

Remove Throttle Plate (Figure 30). Do not remove throttle plate and shaft unless parts are faulty. Remove screws fastening plate, then withdraw plate from shaft and shaft from body. Remove shaft packing retainers, using a screw driver or small pair of pliers.

NOTE: Do not remove identification disk, priming plug, throttle stop pin, float hinge bracket or brass plug from throttle body.

Remove Fuel Bowl Jets (Figure 32). The discharge jet is located in the fuel bowl air passage and may be removed by unscrewing.

To remove main jet, unscrew plug at side of fuel bowl, then remove jet from this passage, using a screw driver.

The well vent jet is located in a passage at the pin. Pivot pinions and spider in carrier gear bore to remove pinions and spider (Figure 54).

Assemble Differential. Place spider, pinions, and thrust washers in their relative mounting positions and install this assembly in carrier gear bore with a pivoting action (See Figure 54). Install spider pin and secure in place with lock pin. Place side gears and thrust washers on each side of carrier gear and secure assembly with carriers and screws.

Install Transmission Differential. Place differential assembly in transmission case. Install bearing cups and new oil seals in bearing carriers. Install carrier assemblies and gaskets on case with screws.
shaft), withdraw bevel gear, and lift forward and reverse sliding gear out of case. CAUTION: Balls and spring will fly out when bevel gear shaft is withdrawn from forward and reverse sliding gear.

Remove inner bearing and shims using a puller. CAUTION: The gear to pinion tooth contact is adjusted when the transmission is assembled at the factory. This is accomplished by placing shims between inner bearing cone and gear. Be certain to tag the shims when removing bearing so that the same shims can be reinstalled on the old or new gear. This will assure correct tooth contact when transmission is reassembled.

Remove First and Second Speed Sliding Gear, remove cotter pin, nut, and brake drum. Remove bearing covers and gaskets. Remove lock rings from shaft. Note: These lock rings must be removed upon removal and should be replaced with new rings when assembling transmission. Slide first and second speed sliding gear on shaft and catch lock balls and spring which will fly out. With gear braced squarely against the transmission case, tap shaft out of bearing cone (the cone at plain end of shaft). Then remove shaft from gear and gear from case.

Remove Reverse Idler and Countershaft Gears. Remove carrier carriers and gaskets, then lift differential assembly out of case.

Disassemble Differential. Remove screws fastening differential gear carriers. Remove carrier, thrust washers, and side gears. The spider pin is held in position by a lock pin. Rotate spider until solid side of spider is aligned with carrier gear opening and tap lock pin out of spider. Withdraw spider center of the machined surface of the fuel bowl and may be removed with a small screwdriver.

Remove Choke (Air Shutter). Unhook choke lever return spring, then unscrew lever retaining nut from shaft end. Remove two screws from choke plate and lift plate out of fuel bowl air passage. Withdraw choke shaft. To remove choke shaft bracket, unscrew nut retaining bracket to bowl.

NOTE: Do not remove air vent channel bushing, choke plate stop pin, or choke bracket locating pin from fuel bowl.

Clean and Inspect Carburetor. Clean fuel bowl, throttle body, and jets with a solvent and blow through each passage and jet with clean dry compressed air.

Inspect float for leaks. Inspect fuel valve needle for ridges caused by heavy tightening of needle in seat. Replace all gaskets when carburetor is disassembled. Replace all parts furnished with Repair Kit (See Parts Book).

Install Choke Plate (Figure 32). Position fuel bowl with machined surface up and facing choke plate opening. Insert choke shaft in body and rotate until flat surface faces down. Insert choke plate, poppet valve first, with valve spring facing down. Center the plate in the bore, rotate shaft to close plate, and install retainer screws. Install choke shaft bracket and retaining nut. Hold plate wide open, and install lever on choke shaft so that lever lug contacts bracket lug. Install lever retaining nut and lock washer. Operate lever to check choke plate for free operation and for opening and closing correctly. Connect return spring at lever and bracket.

Figure 32. Fuel Bowl - Internal View

Install Fuel Bowl Jets (Figure 32). Install discharge jet and fibre washer in fuel bowl air passage. Install well vent jet and fibre washer in counterbored passage at center of machined surface of fuel bowl. Install main jet and fibre washer in passage at side of fuel bowl. Install main jet passage screw plug over main jet.

Install Idle Screw and Jet. Install idle jet in passage at center of throttle body machined surface (Figure 40). When installing idle adjusting screw, tighten lightly and carefully, then loosen one turn.

Install Throttle Plate and Shaft (Figure 31). Install shaft packing and retainer as an assembly, using a light hammer. If old shaft is used, install shaft with stop lever assembled to shaft. If new shaft is used, assemble shaft and plate to throttle body, then install stop lever. Proceed as follows:

Insert new throttle shaft in bore and place throttle plate in position in air passage. Install plate retaining screws, centering plate in bore before the screws are tightened. Install stop lever on throttle shaft. With plate in the straight up-and-down position in bore, rotate stop lever on shaft until the lever is resting against the stop pin, then drill stop lever, using a No. 45 drill. Secure lever with taper pin.

Install Float and Fuel Valve (Figure 30). Install fuel valve seat and gasket. Place body-to-bowl gasket on throttle body. Install fuel valve needle and float. Install float axle in solid end of bracket, then tap end of axle to force it into the slotted end of the bracket, using the handle of a screw driver. Test float action to make sure that float moves freely on axle. Adjust float level as described under heading Carburetor Adjustments at beginning of this section.

Assemble Carburetor. Place venturi in position in the throttle body. Carefully place fuel bowl on throttle body, taking care to avoid altering float adjustment or damaging float and gasket. Install assembly screws and tighten them evenly and securely.

GOVERNOR

The governor is mounted in a recess in the camshaft gear and is automatic in action. Flyweights, which are linked to the carburetor throttle shaft by levers and rods, control the opening of the carburetor throttle plate.

There is no solid connection between accelerator pedal and throttle plate. The engine speed is controlled by means of spring tension, as shown in Figure 33. The higher the spring tension, the lower the engine speed; the lower the spring tension, the higher the engine speed. The spring tension is changed by loosening lock nut and turning adjusting nut. After correct speed adjustment is obtained, a
slight surge may result in engine operation. This surge can be eliminated by turning the adjusting screw in the timing gear cover (Figure 33). Loosen screw if surge appears at high speed. Tighten screw if surge appears at idle speed.

**AIR CLEANER**

**TOWNMOTOR** LIFT Trucks are equipped with oil bath type air cleaners to prevent dirt, dust, and other abrasives from entering the engine through the carburetor air intake. Proper attention and regular maintenance are important.

The air cleaner is mounted on front cowl next to the transmission.

To service the air cleaner, loosen wing nut, screw and remove air cleaner. Clean element and bowl thoroughly and fill with clean engine oil (SAE 30 - Summer, SAE 20 - Winter) to level indicated on side of bowl.

The frequency of this service depends on operating conditions. Normally, the air cleaner should be cleaned once weekly. In dusty operating conditions, air cleaner should be cleaned more frequently. Under extreme operating conditions, clean air cleaner once or twice daily.

**FUEL TANK**

Remove Tank. Before removing tank, disconnect positive battery cable at battery, drain fuel from tank. Remove tank cap. Disconnect and remove fuel lines and filter. Loosen tank bracket screws and remove brackets. Lower and maneuver tank until it can be removed.

Inspect and Repair. Inspect tank for indication of fuel leakage. If tank leaks, it is best to replace with new tank. If old tank is to be repaired, it is recommended that work be done by experienced personnel only. In some instances where a customer must repair his own tank, proceed as follows: Fill tank with water to remove gasoline fumes, then drain and dry tank thoroughly. Using a wire brush, clean surface around point of leakage, then solder opening with a soldering iron. \textbf{READER USE A TORCH.}

Install. Before installing tank, make sure it is clean and dry. Glue webbings in place. Place tank in mounting position and install brackets. Install filter and lines. Fill tank with gasoline and inspect for fuel leaks. Connect battery cable.

**FUEL FILTER**

A laminated washer type fuel filter is placed in the carburetor fuel line at the base of the fuel tank. This filter keeps dirt and foreign particles out of the carburetor.

To clean the filter, close shut-off valve. Loosen bowl thumb nut and remove bowl. Clean filter bowl with a solvent. Remove element with fingers. \textbf{CAUTION: Do not use pliers.}

Clean filter element in grease solvent and blow out with compressed air. Element that cannot be cleaned thoroughly should be replaced with new unit. With element removed, open shut-off valve and drain fuel tank in a container until fuel runs clear. Install element with fingers. Install filter bowl with new gasket. Open shut-off valve and inspect for fuel leaks.

**TRANSMISSION**

**DESCRIPTION**

The LT35 Towmotor is equipped with a specially designed transmission-differential assembly. The drive pinion and differential assembly is enclosed in the same case with the transmission gears. The transfer of power at right angles is accomplished by a bevel drive pinion and gear mounted at the top of the transmission. The line of drive from the universal joint is through the bevel drive pinion, the bevel drive gear, through various other gears, and finally to the differential assembly located at the bottom of the case. The pinions engage the differential side gear splines and transfer the power to the internal drive gears mounted inside the drive axle wheels. The differential assembly, bevel drive pinion and gear are supported by tapered roller bearings. The countershaft and reverse idler gear shafts are supported by oilite bushings.

A gear-type oil pump is placed at the top of the transmission case to assure positive lubrication. This pump forces the oil from the lower section of the case and sprays it over the gears mounted at the upper section of the transmission.

**TRANSMISSION REPAIR AND REPLACEMENT**

It is recommended that the hydraulic mast assembly be removed to replace the transmission assembly. With mast removed, remove transmission cover and inspect gears for worn, broken or chipped teeth. Check bearings for excessive end play, roughness or looseness. If parts are faulty, remove transmission and disassemble completely as described below, inspecting each part for defects. Remove the drive wheels, jackshafts and jackshaft covers. Disconnect universal joint yoke. Remove brake band and gear shift levers. Remove screws fastening transmission case to drive axle carrier and remove transmission assembly. Bevel Drive Gear and Pinion Set Replacement. If either the bevel drive gear or pinion and gear is to be replaced, replace both of the parts as a set. On Serial No. 354600 or above, the transmissions were equipped with a new style gear and pinion set. When replacing these parts on vehicles with serial number 354600 or below, a new style nut is required to make the set entirely interchangeable (See Parts List).

Remove Shift Yokes. Remove lock wires and set screws from yokes. Withdraw shafts from yokes and lift yokes out of case.

**Remove Bevel Drive Pinion Assembly.** The pinion can be removed as an assembly by unscrewing pinion bearing sleeve screws. Then withdraw pinion and sleeve assembly from case.


**Assemble Bevel Drive Pinion and Adjust Bearings.** Tap bearing cups in sleeve. With inner cone installed on pinion, insert pinion in sleeve. Place spacer, shim, and outer bearing cone on pinion and install yoke. Secure yoke with cot. Check bearing end play by hand. Pinion should rotate freely without end play. Adjust bearings by removing or installing shims between bearing and spacer. With pinion bearings correctly adjusted, remove nut and yoke. Install spacer and new oil seal. Install yoke and secure with nut and cotter pin.

**Remove Bevel Drive Gear.** Disconnect oil pump line and remove housing screws. Remove oil pump assembly and coupler. Remove gear shift lever bracket and gasket. Remove cotter pin, nut, and washer. Press bevel gear partially out of case until outer bearing cone is removed from bevel gear shaft. Remove lock ring (adjacent to threaded end of gear tooth) from outer bearing cone and bevel gear shaft.
move filler plugs and attach plugs to cell vents. Fill each cell to the top of the filler plug opening with distilled water. Remove plug from vent and the electrolyte level will automatically drop to its correct level. Be sure filler plugs are replaced tightly, otherwise they may work loose. Also make certain vents are not plugged.

Battery Charge Condition. Check specific gravity of the electrolyte to determine battery charged condition. The following hydrometer readings indicate battery charge conditions:

- 1.275 to 1.300 ............ Fully Charged
- 1.225 ...................... Half Charged
- 1.150 ...................... Very Low

If specific gravity reading is 1.200 or below, charge battery. Be sure electrolyte is at correct level and that filler plugs are removed when charging battery.

**EXHAUST SYSTEM**

The exhaust system consists of a manifold, flexible asbestos-packed exhaust pipe and muffler. On early models, the muffler is threaded into the top surface of the floating plate. A nipple, with elbow attached, is threaded into the opposite side of the floating plate. This elbow and nipple serve as a tail pipe. To remove muffler, disconnect flexible pipe and unscrew muffler from floating plate. On later models, the muffler is clamped to a nipple screwed into the floating plate. When replacing any parts, loosen clamp at bottom of muffler, disconnect bracket, then remove muffler, pipe and bracket assembly.

The muffler for the early models has been discontinued. Therefore, when ordering old mufflers you will be furnished a new muffler, two clamps and one nipple to revise muffler installation to current specifications.
REPAIR AND REPLACEMENT

It is recommended that the distributor be removed each six months of vehicle operation and inspected as outlined below:

Clean or Replace Points. Inspect breaker point contact faces. If they show a grayish color and are only slightly pitted, clean them with a point file or No. 00 sandpaper. If they do not clean up easily or are pitted and burned, replace them. NOTE: If breaker points are burned, replace condenser as it is probably the cause of this condition.

Adjust Breaker Point Gap. After cleaning or replacing points, be sure contact faces are in perfect alignment, then adjust gap to .020 inch (Figure 48). Always recheck gap after tightening point screw locknut.

Inspect Condenser. When checking distributor, the condenser should always be tested for both leakage and capacity with a condenser tester. The function of a condenser is to prevent excessive arcing at the contact points. The condenser must be in good condition and of correct capacity (.20 to .25 microfarad) to assure good performance and to protect the life of the contact points.

Inspect Distributor Cap and Rotor. Clean distributor cap and rotor thoroughly, using carbon tetrachloride. Inspect cap for cracks, carbon runners, and corroded or burned terminals. If defects cannot be removed by cleaning, replace cap. Inspect rotor for cracks and check metal strap for burning. Replace a faulty rotor.

Replace Distributor. Before removing distributor, rotate engine until rotor is in position to fire No. 1 cylinder. This will assure correct position of rotor when reinstalling distributor. Remove distributor cap and disconnect coil wire. Remove hold-down screw and lift out distributor.

Install distributor so that rotor is in position to fire No. 1 cylinder. If engine has been rotated after distributor was removed, install as follows: Remove No. 1 spark plug and rotate engine slowly until No. 1 piston is coming up on its compression stroke. Continue to rotate engine slowly until timing mark (T. D.C.) on the flywheel aligns with pointer. Then install distributor so that rotor is in position to fire No. 1 cylinder.

SPARK PLUGS

To insure efficient engine operation, clean spark plugs frequently with a sand-blast type of cleaner. Replace a plug that cannot be thoroughly cleaned. Change spark plugs after each 500 hours of operation. Always use original equipment type of plug for replacement (See Parts Book). Before removing plugs, make certain all dirt is removed from cylinder head well. The spark plug gap should be set at .030 inch.

IGNITION COIL

When ignition trouble is evident, do not condemn the coil without making certain all electrical connections are clean and tight. Then check condition of coil with testing equipment. If testing equipment is not available, test coil as follows: With coil and distributor installed, rotate engine with ignition switch on, holding coil high tension cable close to cylinder block. If spark is shorter than 1/2 inch or if no spark occurs, coil is faulty.

BATTERY and CABLES

The battery for Model L735 TOWMOTOR is mounted on a counterweight directly below the driver's seat and is easily accessible by lifting the seat cushion. The battery positive post is connected to the side terminal of the solenoid switch. The negative post is grounded to the clutch housing mounting screw.

After each week of operation the battery should be checked as outlined below.

Clean Battery. Keep battery and cable terminals clean. Corrosion can be removed from battery posts and cable terminals, using a wire brush. Wash battery and cable terminals with ammonia and rinse with clean water. After cleaning, coat terminals and posts lightly with grease to prevent corrosion.

Electrolyte Level. Check electrolyte level. If the level is below 3/8 inch above top of plates, re-
IGNITION SYSTEM

FLYWHEEL
FLYWHEEL POINTER

INSPECT AUTOMATIC SPARK ADVANCE. After adjusting timing correctly and with neon light connected as described above, accelerate engine rapidly from idle speed and watch flywheel mark movement. If the spark advance is working correctly, the mark will move counterclockwise on the flywheel when accelerating the engine. It will drop back to its original position when engine is decelerated to idling speed.

DISTRIBUTOR

DISTRIBUTOR CAP
IDLER PLATE
BREAKER PLATE
BREAKER POINT
CURRENT PASS
CURRENT PATH
LOCK NUT
LEAD WIRE
PLUNGER SPRING
ARMS INTERMEDIATE CAP
ARMS WIPER
ARM CLAMP SPREAD
ARM CLAMP SCREW
FACTOR PINS
ASSY ADVANCE ARM
REQUIREMENTS
REQUIREMENT
GASKET
GASKET
GASKET
SHIELD WASHER
HEX WASHER
SCREW
CAREFUL WORKING HANDS
CARE
CAREFUL WORKING HANDS
CARE
CAREFUL WORKING HANDS

COOLING SYSTEM

The cooling system consists of the radiator, water connections, fan blade, fan mounting, fan belt, and water jackets in the cylinder head and block. Water is circulated by the thermostatic system. The cooling system capacity is 8 gals.

CLEAN COOLING SYSTEM

GENERAL FLUSHING. Operate engine until hot. Open radiator drain cock. Attach hose to radiator filler pipe and run water continuously through cooling system with engine operating. Continue this operation until water runs clear. Close drain cock, fill system with clean water and add rust inhibitor.

REVERSE FLUSHING. Reverse flush radiator and engine separately. To flush radiator, remove upper and lower radiator hoses. Insert radiator cap. Attach a hose to top and bottom radiator elbows. Force water with a pulsating action through radiator lower elbow, using a flushing gun or water hose. This pulsating action will loosen rust and scale accumulated in the core passages. Flush engine in the same manner with gun nozzle in cylinder head water connection.

CLOGGED RADIATOR. If flushing does not clean radiator, it is recommended that radiator be removed and boiled out by a reliable radiator shop.

CLEAN RADIATOR CORE AIR PASSAGES. Clean radiator core air passages by blowing out with dry compressed air or steam from outside toward engine.

FAN BELTS

It is very important to inspect the fan belt occasionally, making certain no oil or grease is accumulating on it and that belt tension is adjusted properly. Replace oil or grease-soaked belt.

REPLACE BELTS. Loosen belt tension, slide belt off generator and crankshaft pulleys, then thread belt from one pulley to other, and install on generator and crankshaft pulleys.

ADJUST BELT TENSION. Adjust belt tension to 1/2 inch finger-pressure deflection between pulley centers.

Ref. No.
1
2
3
4
5
6
7
8
9
10

DESCRIPTION
PULLEY
BEARING, fan pulley shaft
GASKET, bearing to pulley
GASKET, oil screw
GASKET, spacer to pulley
NUT, double
NUT, fan pulley shaft
PIN, cotter, fan pulley shaft
SCREW, fan blade to pulley
SCREW, oil, pulley

Ref. No.
11
12
13
14
15
16
17
18
19
20

DESCRIPTION
SHAFT, fan pulley shaft
SPACER, fan blade
WASHER, fan bracket spacer
WASHER, lock, fan blade to pulley
FAN BLADE
BELT, fan
BRACKET, fan mounting
SCREW, fan bracket to block
WASHER, lock, fan bracket to block
Loosen generator brace screw and pivot generator on its mounting to adjust belt deflection.

**FAN AND MOUNTING**

The fan and pulley assembly is mounted on a bracket at the front of the engine. The blades are designed and mounted so that air will be blown out through the radiator core instead of being drawn in. This type fan is usually called a “panther” fan.

The fan blade itself is mounted on the pulley which rotates on a stationary spindle. This pulley is hollow and contains oil, which serves as a lubricant for the spindle bearing.

**Remove Fan Mounting.** Remove body side plate and fan belt. Remove cotter pin and slotted nut at rear of bracket. Move fan and pulley assembly toward radiator until pulley is removed from bracket, then maneuver fan assembly until it can be removed.

**Disassemble Fan Mounting.** Remove screws fastening fan blade, then remove fan spacer, gasket, and double nuts. Remove cotter pin at threaded end of spindle and withdraw spindle and bearing assembly.

**Assemble Fan Mounting.** Place gasket on bearing support and insert bearing and spindle in pulley. Place gasket, spacer, and fan blade on bearing and secure with screws and double nuts.

**Install Fan Mounting.** Maneuver fan and mounting assembly into mounting position and secure to bracket with slotted nut and cotter pin. Install fan belt and adjust deflection to 1/8 inch.

**Lubricate Fan Spindle Bearings.** Remove slotted pipe plug from hub and fill half full with engine oil.

The level can be checked by turning fan until plug hole in hub is halfway between top and bottom of hub. Oil should level with the plug hole with hub in this position.

**RADIATOR**

**Remove Radiator.** Remove radiator filler cap, cover, and grille. Remove fan belt and fan mounting assembly. Disconnect upper and lower radiator hoses. Remove screws at top and bottom of radiator, then lift radiator and shroud assembly from vehicle.

**Inspect and Repair Radiator.** Inspect radiator for clamp or rusted areas which indicate leakage. Soda water radiator to repair leaks. If leaks are numerous, install a new radiator assembly.

**Inspection for bent fins.** If fins are badly bent, straighten carefully with a blunt instrument. When performing this operation, be careful not to puncture tubes.

Inspect for obstructions in core tubes, looking through inlet and outlet passages. Seal upper water passage and fill radiator with water. Inspect for a steady and full stream of water flowing out of lower passage. If stream is small or erratic, the core tubes are restricted. It is recommended that radiator be bolted out by any reliable radiator shop.

**Install Radiator.** Place radiator assembly in mounting position in vehicle and secure with screws at top and bottom. Connect radiator hoses. Install fan and mounting assembly and fan belt. Fill cooling system with water and inspect for leaks. If installation is O.K., install radiator grille and cover.

**Replace Field Coils (Figure 45).** Remove solenoid switch connector. Remove nuts and washers from field terminal stud. Remove screws fastening pole shoes and lift shoes out of coils. Disengage terminal stud from frame and withdraw coil assembly from frame.

To install coil, place insulating washer on field terminal stud and insert field assembly in frame, engaging terminal stud with hole in frame. Install insulating strip between field coil connections and frame. Install field pole shoes and secure with screws. Place insulating bushing, insulating washer, plain washer, and lock washer on terminal stud and secure with nut. Install solenoid switch connector.

**Inspect and Replace Brushes.** If brushes are oil soaked or are worn to one-half or less of their original length, replace them.

To remove brushes connected to field coil lead, heat terminal with soldering iron and spread connector loop. To install brush, clinch loop securely around brush lead, then solder the connection.

To remove brushes connected to commutator end brush, drill out rivets fastening brush holder. Remove holder and brush. When installing new brushes, make certain rivets are staked securely to assure a good electrical connection.

**Inspect Brush Holders.** Inspect brush holders for damage or loose rivets. Inspect for poor connection or short-circuit with test lamp as follows: Connect test lamp to grounded brush holder and end head. If lamp does not light, holder has faulty ground connection. Repair grounded brush holder if ground connection is faulty. Connect test lamp to insulated brush holder and end head. If lamp lights, the brush holder is shorted. Replace end head assembly if holders are faulty.

**Test Brush Springs.** Hook a five-pound scale to the brush spring and pull until brush just leaves surface of the commutator. Reading on the scale is the brush spring tension, which should be 38 to 61 ounces for the old type starting motor; 42 to 53 ounces for the new type. To adjust spring tension, twist the slotted hinge at the point where spring is attached.

**Inspect and Replace Bendix Drive.** To remove Bendix drive, remove cotter pin and slotted nut, then lift Bendix drive parts and drive end head off armature.

Clean Bendix drive parts thoroughly and inspect for wear. Check for distorted springs. Replace faulty parts.

To install Bendix drive, place drive end head on armature. Install large thrust washer, drive spring, spring, support, meshing spring, and large thrust washer on armature shaft. Insert screw sleeve in pinion and install this assembly on shaft. Install anti-drift spring sleeve, small thrust washer, anti-drift spring, and spring cap, on shaft and secure Bendix drive with nut and cotter pin.

**Assembly Starting Motor.** With Bendix drive assembled to armature and field coil installed in frame, assemble starting motor as follows: Install armature assembly in frame. Temporarily pull brushes from holders and through frame openings. Position commutator end head on frame and pull brushes through adjacent frame openings. Install screws holding starting motor assembly together. Before inserting brushes in holders, inspect armature end play for a clearance of 1/16 inch, and adjust if necessary by installing thrust washers on commutator end of armature.

With a hooked end tool, pull out on brush spring (Figure 44) and insert brushes in their respective holders. Install inspection band.

**Install Starting Motor.** Place starting motor in mounting position and secure with bolts and nuts. Connect battery cable, horn wire, and ammeter wire to switch side terminal. Connect push button starting switch wire to upper terminal. Connect cable to battery.
STARTING MOTOR

DESCRIPTION

All LT35 TOWMOTORS Serial No. 3549167 or above are equipped with a new type of starting motor. The new type starting motor is also used for replacement on all machines Serial No. 3549160 or below.

The starting motor consists of four field coils, two grounded brushes, two insulated brushes, armature, compression spring type drive, and a solenoid switch. Electrical connection to battery is made through the solenoid switch mounted on the starting motor frame and push-button switch mounted on the instrument panel. Depressing push-button switch operates solenoid switch which, in turn, connects starting motor to the battery.

STARTING MOTOR SPECIFICATIONS

<table>
<thead>
<tr>
<th>Voltage</th>
<th>6 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poles</td>
<td>4</td>
</tr>
<tr>
<td>Brushes</td>
<td>4</td>
</tr>
<tr>
<td>Direction of Rotation</td>
<td>Counter-clockwise at drive end</td>
</tr>
<tr>
<td>Brush Spring Tension</td>
<td>Old Type Starting Motor 38 to 81 ounces</td>
</tr>
<tr>
<td>Armature End Play</td>
<td>1/16-inch maximum</td>
</tr>
<tr>
<td>Drive</td>
<td>Left Hand Outboard Bendix</td>
</tr>
</tbody>
</table>

STARTING MOTOR REPAIR AND REPLACEMENT

Periodically, the starting motor should be removed, disassembled, and inspected as recommended below.

BRUSH.png

1. Fig. 44. Removing Brush From Holder

INSULATED COIL FIELD TERMINAL INSULATING BRUSH NO. 1 STUD WASHER

Fig. 45. Field Coil Installation

Remove Starting Motor. Disconnect positive cable at battery, then disconnect wires at solenoid switch. Remove bolts and nuts fastening starting motor to clutch housing and remove starting motor.

Disassemble Starting Motor. Remove inspection band. Remove insulated brushes from holders as shown in Figure 44. Remove commutator end head screws. Remove commutator and head and withdraw armature assembly from frame.

Inspect and Repair Armature. Inspect armature for visual mechanical defects. If commutator is dirty or gummed, clean with No. 00 sandpaper. If the commutator is rough or worn, turn down in a lathe.

Test Armature. After armature commutator has been cleaned, test for grounded windings or commutator bars with a test lamp connected to bars and armature shaft. If lamp lights, a ground is indicated. Test for short-circuit in windings by placing armature in a growler (Figure 38). Hold a hack-saw blade over armature as armature is revolved in growler. If a magnetic or vibrating effect is created on the blade, the armature is short-circuited. Replace a faulty armature.

Inspect and Test Field Coils. To test coils for ground, connect one lead of test lamp to the frame and the other to the insulated brush. If a ground is present, the lamp will light. Replace a grounded field coil.

ELECTRICAL SYSTEM

"GENERATING SYSTEM"

Fig. 35. Electrical System Diagram

Generator

The generator is the third brush type with a ball bearing in the drive end and bronze backing in the commutator end. The generator employs two main brushes (one insulated and the other grounded at the brush holder) and one third brush. The third brush (thinnest of the three) controls the generator output at any particular voltage. Voltage is controlled by a voltage regulator mounted on top of the generator. Movement of the brush toward adjacent main brush increases charging rate; movement of the brush away from adjacent brush decreases charging rate. An approximate measurement of generator output is registered by the ammeter on the instrument panel.

GENERATOR SPECIFICATIONS

<table>
<thead>
<tr>
<th>Voltage</th>
<th>6 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poles</td>
<td>2</td>
</tr>
<tr>
<td>Brushes</td>
<td>2</td>
</tr>
<tr>
<td>Control</td>
<td>Third Brush and Regulator</td>
</tr>
<tr>
<td>Rotation</td>
<td>Clockwise at drive end</td>
</tr>
<tr>
<td>Brush spring and cushion</td>
<td>50 to 60 ozs.</td>
</tr>
<tr>
<td>Armature End Play</td>
<td>.003 to .010</td>
</tr>
<tr>
<td>Maximum safe output</td>
<td>8 Amperes</td>
</tr>
</tbody>
</table>
and electromagnet core and adjust to .020 inch clearance by bending armature stop. After adjusting, be sure stop does not rub against side of armature.

Adjust Circuit Breaker Point Gap. (Figure 40). Check point gap using a .006-inch flat gage. Insert gage between points and adjust gap to .050-inch clearance by contracting or expanding stationary point bridge, using needle-nose pliers. Expand for less clearance and contract for more clearance. Keep points in perfect alignment while adjusting. After adjusting, inspect points for closing before armature contacts cores.

Adjust Circuit Breaker Point Closing Voltage. Connect a voltmeter across armature wire (gray) terminal marked "A" and ground on regulator base. Adjust closing voltage by bending lower spring hanger to vary tension on circuit breaker armature (Figure 41). Increasing spring tension raises closing voltage; decreasing spring tension lowers closing voltage. The circuit breaker should close at 6.50 to 7.25 volts.

Adjust Voltage Regulator Armature Air Gap. (Figure 41). Check air gap using a 0.045-inch flat gage. With regulator points closed, insert gage between armature and electromagnet core and adjust gap to 0.045-inch clearance by contracting or expanding stationary point bracket, using needle-nose pliers.

Adjust Voltage Regulator Point Gap. (Figure 41). Check point gap, using a .006-inch flat gage. Insert gage between points and adjust gap to .005-inch clearance by bending spring cam located under armature at contact point end.

Adjust Voltage Regulator Point Opening Voltage. (Figure 40). Adjust opening voltage of the regulator by bending lower spring hanger to vary the tension on voltage regulator armature. Connect a voltmeter to battery terminal marked "B" and to ground on regulator base. Increase spring tension to raise voltage and decrease spring tension to lower voltage. The closing voltage is controlled by the armature air gap. The voltage regulator should open at 6.00 to 6.75 volts (variations due to temperatures) and should close at 1.2 to 1.4 volts below opening voltage.

REGULAR REPLACEMENT

Remove. Disconnect positive cable at battery and armature cable at regulator. Remove screws fastening regulator to generator and disconnect wires at connection in base of regulator. Remove regulator.

Install. Connect wires in base of regulator; connect insulated main brush wire (gray) terminal to terminal marked "A", field wire (red) terminal to terminal marked "F". With regulator fuse pointing away from engine, install and tighten regulator mounting screws. Be sure to use screws of the correct length; if screws are too long, they will embed in the field coils and cause a short-circuit.

ADJUSTMENT

Adjust Third Brush. The third brush holder is mounted on a movable plate secured by two spring clips. These spring clips hold the plate in position and permit movement of brush and plate by finger pressure. Movement of brush toward adjacent (insulated) main brush increases charging rate; movement of the brush away from adjacent brush decreases charging rate. To obtain the highest safe output of the generator, adjust the third brush position until there are two commutator bars exposed between third brush and adjacent main brush.

GENERATOR REPAIR

Inspect and Repair Generator. It is recommended that the generator be removed, disassembled and inspected as outlined below.

Remove. Disconnect positive cable at battery. Disconnect fan belt from generator pulley. Disconnect cable at regulator terminal. Remove cap screws fastening adjusting brace to generator and cap screws fastening generator mounting bracket to cylinder block. Then remove generator and regulator assembly.

Disassemble Generator. Remove mounting bracket, regulator, and inspection band from generator. Remove screws fastening and leads to generator frame. Remove armature and drive end and head assembly. Disconnect wires at brush holders and remove commutator and brush assembly.

NOTE: With generator disassembled into major subassemblies, it is recommended that the following inspections and tests be made:

Inspect and Repair Armature. Inspect armature for visual mechanical defects. If commutator is dirty or gums, clean with No. 60 sandpaper. If it is rough or worn, turn down a lathe. Replace armature if removal of 1/32 inch is not sufficient to clean commutator correctly. After turning commutator, undercut nicks to a depth of 1/32 inch.

Undercut Commutator Mica. To undercut high mica condition, use a special undercutting tool and machine or a hand tool made by grinding a fine-tooth hack-saw blade to fit the exact mica width; wrap friction tape around one end to provide a handle. Undercut mica square, 1/32 inch deep to the full length of the commutator bars as shown in figure 37. After this operation, remove bars from commutator bar edges with No. 00 sandpaper and blow dust out with compressed air.

Test Armature. After armature has been cleaned, test for grounded windings or commutator bars with a test lamp connected to bars and armature shaft. If lamp lights, a ground is indicated and armature should be replaced. Test armature for short-circuit by placing in a growler (Figure 38). Hold a hack-saw blade over armature as it is revolved in growler.

Fig. 37. Undercutting Commutator Mica

Fig. 38. Testing Armature in a Growler

START GROOVE IN MICA WITH 3 CORNED RILE

COMMITATOR

MICA

SEGMENTS

HIGH WAY

RIGHT WAY

MICA MUST BE CUT AWAY CLEAN BETWEEN SEGMENTS

MICA MUST NOT BE LEFT WITH A THIN EDGE NEXT TO SEGMENTS

WONG WAY

MICA

MICA

MICA

GROWLER

37
If a magnetic or vibrating effect is created on the blade, the armature is short-circuited and should be replaced. Be sure commutator slots are clean and inspected for visual defects in winding insulation. If windings appear satisfactory, do not make additional repairs. Reinstall armature.

Inspect and Test Field Coils. To check coils for open circuit, connect a test lamp to the two leads of each coil. If lamp fails to light, the coil circuit in open and coil should be replaced.

To check for grounds, connect one lead of test lamp to the frame and the other to the field coil terminals. If a ground is present, the lamp will light. Replace coil when a ground is indicated.

Replace Field Coils. Pry rubber grommet out of frame hole and remove screws centering pole shoes. Lift shoes out of coils and slide field coil assembly out of frame.

To install coil, place assembly in frame. Insert regulator and field wire through frame hole, then install grommet. Insert insulating strip between field connections and frame (Figure 39). Install field pole shoes and secure with screws.

Inspect and Replace Brushes. If brushes are oil-soaked or worn to one-half or less of their original length, replace them.

When replacing brushes, the new brushes should have 100 percent surface contact with the commutator. To accomplish this, use a brush seating stone or No. 00 sandpaper. Proceed with the latter method as follows: Place armature in soft-jawed vise and wrap two layers of No. 00 sandpaper tightly around commutator (advise side out) in such a manner that revolving brushes will rub over projecting edges of paper. Place commutator end and brushes in normal position on commutator. Hold sandpaper in place and rotate end with clockwise until brushes are seated correctly. Remove dust and dirt with clean dry compressed air. Do not use sandpaper method to excess as this will shorten life of brushes.

Inspect and Test Brush Holders. Inspect brush holders for damage or loose mounting rivets. Inspect for poor connection or short-circuit with a test lamp as follows: Connect test lamp to grounded brush holder and end lead. If lamp does not light, holder has faulty ground connection. Connect test lamp to insulated brush holder and end lead. If lamp lights, brush holder insulation is shorted. Replace end head assembly if holders are faulty.

Test Brush Springs. If generator is disassembled, assemble commutator end and brushes temporarily to test brush spring tension. Hook a five-pound spring tension scale to the brush spring arm and pull until brush just leaves surface of the commutator. Reading on the scale is the brush spring tension, which should be 20 to 25 ounces. Replace end head assembly if springs are faulty.

Inspect and Replace Armature Bushing. Inspect bushing for wear, scoring, and press fit in commutator end. If faulty, replace as follows: Remove screws and lock washers securing cover. Remove cover and gasket. Press bushing, oil guard, and gasket out of end. To install bushing, start bushing (oil slot aligned with oiler felt) in end head with soft-faced hammer. Press bushing in end head until bushing edge flush with outer edge of head. Place gasket on oil guard and tap this assembly into end head. Install bushing cover and screws.

Inspect and Replace Armature Ball Bearing. Inspect bearing for free rotation. Replace a binding bearing. If bearing has evidence of having operated with lack of lubricant, replace it.

To remove bearing, unscrew pulley nut and press pulley off armature, using arbor press. Remove key and spacer from shaft, press end head and bearing off shaft. Remove screws fastening bearing retainer, then lift retainer, felt seals and bearing from end head.

Before installing bearing, pack it with a high melting point grease and sink the felt in medium oil. Place felt seal and corrugated retainer, ball bearing, inner seal retainer, felt seal, and bearing retainer in end head. Be sure oil holes are aligned. Secure bearing retainer with screw. With small felt seal retainer and lock ring on armature shaft, place drive end head assembly on armature. Press head assembly on shaft and install pulley spacer and key. Press pulley on shaft and secure with nut and lock washer.

Assemble Generator. With regulator and field wires extending out of the frame brush openings, position commutator end head and armature assembly on frame. Install frame screws; be sure they do not contact field coils or connections. Inspect armature end play before installing brushes. If in excess of 0.010 inch, adjust by inserting thrust washers on commutator end of armature shaft.

When installing brushes, place lead wire connections toward armature, insert thin brush in moveable third brush holder, and insert thick brushes in main brush holders. Raise tension spring arm with a hooked-end tool and insert brushes (Figure 44). Connect grounded main brush terminal to brush holder. Connect regulator wire (green) and main brush wire to insulated main brush holder (Figure 39). Connect field wire (black) and third brush wire terminal to third brush holder. Be sure wires do not rub the armature; otherwise, insulation will be torn, causing a short circuit. Install inspection band and tighten retainer screws.

Position mounting bracket on end plates and install bolts and nuts. Tighten nuts until there is a slight resistance when attempting to pivot generator on its bracket.

Install Generator. Position generator and bracket on engine block and secure bracket with cap screws. Install fan belt on pulley, and secure drive end head to fan belt adjusting holes. Adjust fan belt to 1/4 inch deflection. Connect ammeter wire to regulator terminal marked "B." Connect positive battery cable. Start engine and inspect generator output rate. If necessary, adjust generator third brush.

Polarize Generator. After installing generator and before starting engine, correctly polarize the generator. Connect a jumper cable momentarily to starting switch battery connection and regulator armature terminal marked "A." This momentary surge of current from battery to generator will correctly polarize the generator with respect to the battery.

REGULATOR SPECIFICATIONS

<table>
<thead>
<tr>
<th>Type</th>
<th>Two-charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battery Capacity</td>
<td>5 amps</td>
</tr>
<tr>
<td>Circuit Breaker Tolerances</td>
<td></td>
</tr>
<tr>
<td>Armature air gap</td>
<td>0.20</td>
</tr>
<tr>
<td>Contact point gap</td>
<td>0.009</td>
</tr>
<tr>
<td>Point closing voltage</td>
<td>6.5 to 7.25V</td>
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<tr>
<td>Point opening current</td>
<td>0.6 to 2.5 amp</td>
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<tr>
<td>Voltage Regulator Tolerances</td>
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<tr>
<td>Armature air gap</td>
<td>0.045</td>
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<tr>
<td>Contact point gap</td>
<td>0.005</td>
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<tr>
<td>Point opening voltage</td>
<td>3 to 6.75v</td>
</tr>
<tr>
<td>Point closing voltage</td>
<td>0.6 to 7.3</td>
</tr>
</tbody>
</table>

REGULATOR ADJUSTMENTS

Adjust Circuit Breaker Armature Air Gap. (Figure 40). Check air gap, using a 0.001 inch flat gage. With the points open, insert gage between armature